FORD

HENRY FORD MOTOR GENIUS by William A. Simonds

HARLAND EASTWOOD
12835 - 24th Ave. South
Seattle, Wash. 98168

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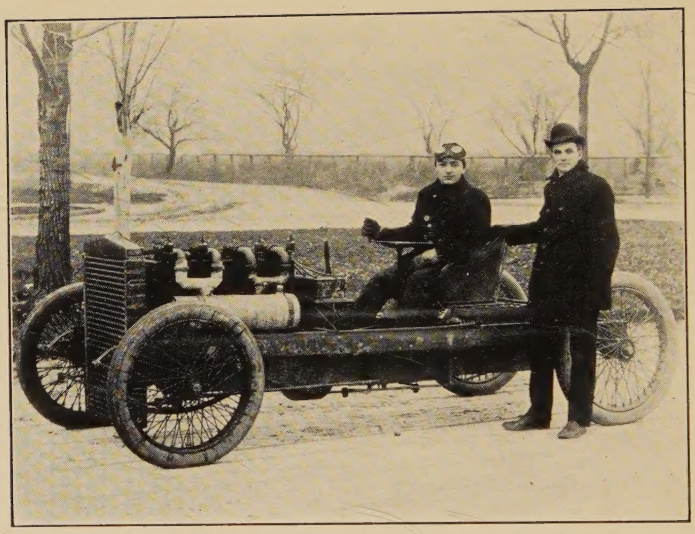
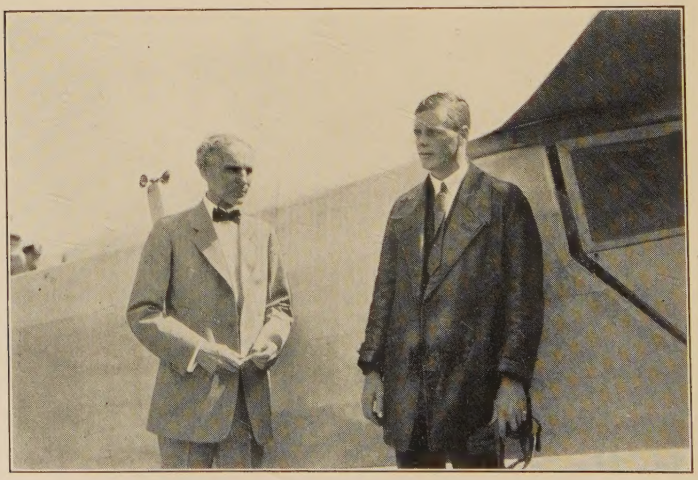


Henry Ford and the famous racing car, "999," which he built. Barney Oldfield is at the wheel (or two-handled steering lever) and Henry Ford stands alongside.



HENRY FORD AND COLONEL LINDBERGH

HENRY FORD
MOTOR GENIUS

BY

WILLIAM A. SIMONDS

INCLUDING A PICTORIAL SUPPLEMENT
SHOWING A TRIP THROUGH
THE DEARBORN PLANT

FULLY ILLUSTRATED

1929

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GARDEN CITY, NEW YORK

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TO

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HENRY FORD
MOTOR GENIUS

CHAPTER I

LOOKING FOR A JOB

ON AN early fall day in 1880 a boy walked along the shady side of a road in southern Michigan toward Detroit. He was slender, tall, and wiry. His features were fair and his eyes earnest. As he swung in and out among the trees along the path his stride was purposeful and manly.

It was that time of the year when the big maples along the River Rouge were splotched with crimson and gold, and when the sumach fringing the rail fences and stone walls looked sunburned and blood-red. Troops of goldenrod on the edges of the fields mingled with the somber, fragrant everlasting. Clumps of hazelnut bronzed in the sun. From a clearing in a grove the buzz of children's voices came through the open windows of a small red brick schoolhouse.

Just ahead of the boy beyond the bend in the road were the outskirts of the city, toward which

he was heading. It stretched away as far as his eyes could see, a conglomerate mass of roofs, foliage, and chimneys. Long streets led southward, twisting and turning and then straight again, until at their very end they reached the Detroit River. It was his first trip to the city alone, although he had driven there many times in the past with his father. His mission now was to find a place where he could get a job.

Once inside the city limits he continued on toward the business district. Street after street after street was passed, seemingly hundreds of them. Occasionally he crossed an intersection on a raised wooden walk that was just high enough above the road to keep one out of mud and snow when the weather was bad. He came to a place where the row of houses stopped and the business section began. Here the pavements were smelly; the buildings lifted their spires and lightning rods fully six stories into the clouds! Down the center of the street ran lines of track, along which a horse car jerked and slid every few minutes.

The boy turned down the principal street—Woodward Avenue—and saw in the distance the blue waters of the Detroit River sparkling in the sunshine. On the other side, hardly more than a

stone's throw distant, he could see Canada, wooded hills rolling back toward a faraway horizon. Along this border history had been written. The dark, stern figure of Tecumseh had brooded above the strait. Many gallant French, English, and American warriors had halted here from battle. For more than a century the chief importance of the town had been its military value. But after peace had come to the Canadian border, Detroit had changed to a manufacturing city and by now boasted of a hundred thousand residents.

The boy found it a city of metal workers, of foundries, of stove works that covered whole blocks, of brick buildings that were capsule factories. There were plants given over to making organs, hoop skirts, candles, carriages, and the like. But the boy was not interested in ordinary factories or ordinary jobs. He wanted to learn about engines—not how to run them but how to put them together. Detroit was the place for him to get this education.

There were engines about his father's farm and on roads near by, and in them he already had discerned a new giant that was doing the work of men. He even pictured such an engine doing most of the tasks usually found on the farm. He

wondered why it couldn't be made to do the back-breaking jobs of the fields and the chores of the barn. It wasn't that he was lazy, because he did toil wholeheartedly and strenuously, tireless as a steel spring; but he did begrudge the time that was lost in doing things the same old way year after year.

As a boy he had done considerable tinkering with watches and had learned to use some of the finer tools. In all this he had to overcome the objections of his father. The elder Ford was a successful farmer. The old ways were good enough for him. He laughed at Henry's dreams and tried to steer him away from them. At last things got to the point where the boy had to stop dreaming entirely, or else leave home and go down to the city to begin at the bottom on his own.

It was a hard choice for any boy to have to make. Still, there never was any doubt in his mind, either of what he wanted to do or of his ability to do it. He walked into the city alone. He picked out the place where he wanted to begin his education. It was one of the better shops of Detroit, which not only did machine work in general, but made steam engines as well.

The gasoline engine had not been developed

in America at that time. Steam was the power that turned wheels. The boy wanted to learn how to build steam engines, then to make them do work for men. He had always been interested in steam. When he was just a little lad he had watched it pouring from his mother's teakettle on the fire and had been fascinated by it. He noticed that some outlet was always provided for steam to escape, and wondered what would happen if it was bottled up so that it couldn't get out.

One day he determined to learn for himself what the result would be. He set an earthenware dish, an old jug or teapot, which he had filled with water and bottled tightly, on the fire. In due time, after the water was boiling nicely, the jug burst apart with terrific force, throwing pieces in all directions, including a few at the boy himself. Luckily his wounds were not serious, although the hot water scalded him painfully, and from that time on he knew what a tremendous power was locked up in steam.

Having discovered this giant, his next ambition was to control it. Whenever he learned of an engine at work in the neighborhood he studied it. Steam was sawing wood and pressing brick; it was hauling trains back and forth on the Mich-

igan Central tracks not far from the farm. Why couldn't a small engine be made so that it could be used about the farm?

He was so keen for information that when he got it it was burned indelibly on his mind. One day, while driving into Detroit with his father, he passed an engine that was moving itself along the road, turning the hind wheels by a chain something like a bicycle. Here was something that he had always wanted to see, a steam engine that did not require a team of horses to pull it around when it had to be moved from one place to another. He persuaded his father to stop long enough for him to run over and look at it.

Meanwhile the engine had halted on one side of the road so that the horses could pass. The engineer good-naturedly welcomed the boy up on the platform and showed him how the chain worked.

The boy never forgot that interview. Thirty years afterward, when he was being examined as a witness in a suit, he was able to recall it. One thing that impressed him was the manner in which the power was disconnected from the rear wheels without shutting off the engine. The ma-

chine could stand still with the engine running, and yet the wheels would not move until the driver was ready to go.

The lawyers asked him how many turns a minute the engine could make. He answered promptly: "I suppose about two hundred."[1]

"Why do you suppose? Why don't you remember?"

"Because I never counted them."

"Why do you guess two hundred?"

"Because I asked the man that was running it how fast the engine could go, and he told me two hundred turns a minute, and I have never forgotten it.'

As he walked into the shop in Detroit on this early fall day in 1880 to ask for a job, he was sure that he was going to get it. No other idea had even entered his mind. Someone pointed out the foreman to him, and he went over. The foreman gave him one glance of keen appraisal and was satisfied. Here was a boy that seemed anxious, not merely to get a job, but to *work*.

"So you want to learn about engines, do you?"

[1]Vol. IX, Transcript of Record, Ford-Selden suit, U. S. Circuit Court of Appeals for the Second Circuit, p. 54.

the man asked, finally. "All right. I'll give you a chance. Be here at seven o'clock to-morrow morning."

The wages, the boy learned, would be $2.50 a week.

CHAPTER II

DETROIT

OUTSIDE the shop once more, the boy set about his next task, that of finding a place to stay. He had never lived in Detroit, but the city was familiar to him. He walked about from one lodging house to another, seeking one where he could have room and board for $2.50 a week. Quickly he discovered that boarding houses were not like home.

For one thing, the rooms were dingy and dirty. His home had always been clean; his mother had taught him to detest dirt and to keep things always in order. Wherever he looked, the places in which he could live decently would cost more than he was going to earn. So he made a second decision. He would choose a clean home and then find a way to earn more money. He didn't doubt at all that he could do it. No other idea entered his mind.

Going back to one of the rooms that he had liked, he rented it for $3.50 a week. He paid in advance for the first week out of a little change that he had in his pocket (it was actually less than five dollars). Then he roamed about till dark, happy in the knowledge that he had a job and a clean place in which to live.

Night came on. Along the shady streets, rows of gas lamps were lighted. Downtown a new-fangled arc light that burned electricity was being used by a few stores. Many good people shook their heads over this: it was dangerous to have lightning around the place! There might be a fire, or someone might get a shock. But the light was cleaner than gas, and some folks even claimed that in time it would be used by almost everybody.

The boy found night in Detroit to be far different from that on the farm. Youngsters played everywhere in the streets, dodging out of the dust as the carriages went by. Men talked together in front of the stores or sat on the porch until dark drove them in. A few homes had telephones, and when the bell rang, the whole family was thrilled. To talk to someone, you merely had to turn the crank on one side of the box, and when Central answered, tell her the name of the person to

whom you wished to speak. The device was already three years old in Detroit, but it still seemed to many people an expensive as well as entirely unnecessary luxury.

Bright and early the next morning the boy reported at the shop. Everything interested him—the arrival of the men for work, the starting up of the machines, the knowledge which the workers seemed to have, the things they were manufacturing. His eagerness impressed his boss. No task was too menial. He seemed to regard a machine as fondly as a pet dog. He hovered over it, cleaned it, smiled when it purred smoothly. The day sped fast. It was six o'clock before he knew it.

As he walked home he was filled with delight, not only because he had earned a day's pay, but because he had learned a lot and had liked his job. After supper he started out on his second quest for work. He had to earn another dollar each week to pay his board, and it had to be something he could do at night. After wandering about for a while he looked up a watch repair shop. As a boy he had taught himself how to tinker with watches.

His first watch, given him by his father, had been a whole laboratory to him. He had taken it

to pieces carefully, put it together again, and done it over and over until he knew every wheel by heart. The first broken watch he fixed had been opened by him with a shingle nail sharpened into a screw driver. Later he fixed all the clocks and watches for miles around his home, using tools that he made himself. There was little that he could not do with them.

This experience now stood him in good stead, for a shopman offered him two dollars a week if he would come at seven o'clock each night right after supper and work until eleven. It was fun to him more than work, for he really loved to make watches run. He knew the function of each wheel, and had he not cared for engines he would have made a first-rate jeweler.

But he did not let the fact that he could make two dollars a week for four hours' work on watches at night coax him away from the machine shop, although there it took him eleven hours a day to earn but $2.50 a week. He was learning something bigger than watches. He made up his mind to master each thing the shop did. Every new task fascinated him until he mastered it.

Just as he had studied farm work, wondering

whether there was not some way in which it could be lightened, he now studied the machine shop. Because a thing was done a certain way, or had been done that way for the past hundred years, did not mean to him that it was being done the best way. He found just as much wasted time and lost motion in the shop as there had been on the farm. The work did not seem to be planned. The men appeared to spend much of their time going from one place to another and from one job to another.

But he was there to learn, not to change things. He got hold of some magazines that specialized in engines and machinery—one of them was named *The World of Science*—and he read these whenever he could squeeze in the time. His work was so satisfactory that his pay was raised to $3.00 a week. Each night except Sunday he went to the watch shop, and each morning he was on the job ahead of time at the machine shop.

Then he was faced with another important decision. He had learned all that the shop could teach him, and the question now came to his mind—should he keep on working there or should he look around for another larger place where he could learn more? It might mean taking

less pay at the start, but with his night work he could manage until the wages were increased. After thinking it over he decided that there was only one thing to do—find a place where he could learn more about engines and there try to get a job.

He picked out the largest machine shop in Detroit, a place which made only marine engines. It was a dry-dock concern and would offer him only $2.50 a week. But he quit his old job and took the new one, feeling that it was one more rung in the ladder that would lead him to his dream.

By that time he had come to love the city that stretched along the river. He found a crowd of young fellows like himself in the dry-dock employ, full of fun, although, unlike himself, they inclined to the wilder sports of that period. Saloons with swinging doors and floors of sawdust were familiar sights in some sections of town, and frequently the young men flocked there after hours. Henry had not acquired the taste of liquor, nor did it appeal to him, but he did not preach his views, and the others respected him and grew to like him. Neither had

he learned to smoke, but that did not keep him from being popular.

There was much about the city that was interesting. For one thing, it was a great stove-producing center. Salesmen went from house to house, just as they do with vacuum cleaners today, and sold stoves to the housewives. Occasionally some big event happened in which the whole town took part. One day a train steamed into the depot for the first time from faraway St. Louis—a tremendous occurrence! On another day the great General Grant came to attend the reunion of the Army of the Potomac.

In the downtown district, where the stores with their narrow doorways and brightly colored awnings made up the business section, horse cars dashed back and forth, the harsh bells on the horse collars clanging fearsomely. Buses from the hotels, stagelike affairs with canopy tops and gilded lettering, met the trains. Beyond the city limits at the point where the streets changed into country roads there were sometimes tollgates, where one had to pay before going through. In places the country roads were made of planking which rattled pleasantly as carriages rolled over. Great planks laid sidewise formed bridges over

the creeks, and wooden railings guarded the edges to keep folks from going off into the water.

Of all the crowd of young men that worked at the new place he alone seemed to be aiming at a purpose. They toiled, many of them, just as hard as he, but to them it was just a way to earn money with which to live and have fun. In time, after their apprenticeship was over, they would become full-fledged machinists and draw bigger pay, marry, settle down, and raise families. It would have seemed foolish to them to suggest that better ways could be found to make engines, for they were satisfied with things as they found them. Why should they study things which other men had already thought out for them?

CHAPTER III

AN ENGINE AND A GIRL

THE boys who grew up during the period in which Henry Ford spent his boyhood felt that most of the great discoveries had already been made and there was little left in the world to find out. The old stagecoach had been replaced, except in the West, by trains which made it possible to go from one city to another in incredibly fast time. Steamships plowed up and down the rivers and lakes and even across the ocean; and the sailing vessels were no longer the best means of crossing water. An instrument had been invented through which messages could be sent on wires for long distances. Down in New Jersey a man had found how to bottle electricity inside of glass and make it shine brightly enough to give light. People were even talking over the telephone.

Once in a while some crack-brained fellow would suggest a horseless carriage, but usually

the idea was hushed up quickly because it made everyone laugh so much. The horse was considered indispensable. It pulled every kind of conveyance from the creaking, low-hung wagons of the breweries, with their rows of kegs and their sour smell, to the high board wagon that the farmer used, with jouncing seat far up in front and a rattling tailboard on behind to keep in the garden truck.

The horse trotted along the wood pavements pulling the doctor's buggy with top shining and whip socket handy. Or it moved majestically down the avenue in front of a round black hack that swung from side to side on wide springs; or it pulled the family carriage, which was large enough to have double seats facing each other in the tonneau. There were flat canopy tops with tassels that waved in the breeze; there were brightly colored plumes for the horses' heads; there were gleaming harness, and nets to keep off the flies. To do away with such a useful and noble animal as the horse was preposterous!

But even more idiotic was the imbecile who suggested that it might be possible for men to fly in the air. There was only one thing to do with such a nitwit, and that was to confine him

promptly in some asylum where he couldn't injure anyone. Balloons, of course, were a different matter. It was a thrilling event to see one at a country fair, swaying in the sky; and to see some daring man in blue tights descend in a parachute. But everyone knew that balloons were lighter than air. The idea that something heavier than air could stay up in it was folly and a sure sign of an overheated brain.

Henry had been at the dry-dock shop only a little while when the whole city was stirred by a proposal to light the streets by electricity. Arc lamps were to be set up on towers 150 feet high and would furnish light for fifty cents a night. The council hall was besieged by boys who had been earning pocket money lighting and extinguishing the gas lamps on regular routes. Electric lights meant they would lose their jobs. Besides, the idea of wires strung all around town was dangerous. The proposal was promptly voted down, and it was two years more before a council was elected that would agree to try out the new method.

In those days, three years were required of a boy to serve as an apprentice before he could become a machinist. Henry worked so eagerly

and learned so well that he graduated from the class before the end of that time. His pay climbed rapidly, until it reached the lofty sum of five dollars a week. He was able now, he felt, to give up his night work at the watch repair shop, because his board and room had not changed, and he had a whole dollar and fifty cents left over each week.

But once more he grew restless as he realized that he had learned all the dry dock could teach him. Once more he had to face the question, should he stay on the job, where he could earn good pay for a boy; or should he continue his education, even if he had to start again at a loss? His next task, he felt, was to put his knowledge of engines to use, and that could be done only by leaving the shop. It did not take him long to decide. He looked up a man who sold portable steam engines and got a job going around to farmhouses, installing the engines and teaching the farmers how to operate them.

At last he was able to approach his dream more closely. A portable steam engine was sure to lighten work on the farm, and it was only a step from that to one that could haul a plow or cultivator or drag in a load of potatoes. True, the job was only a summer one and while it lasted

he had to get up with the sun and work until after dark. But he felt that he was accomplishing something and every time he repaired one of the engines at work, as he did often, he learned something new. He came to know steam engines as well as he did watches, and he was ready at last to do some experimenting for himself.

There was but one place he could do that. It was on the farm. When winter set in and his father asked him to come back home to help with the work, the request could not have come at a more opportune time. Back he went to the farm where, years before, he had rigged up a little machine shop of his own. He had a forge that actually worked well, a lathe, a vise, and an anvil where he could hammer metal after it was heated. Now he could replace those juvenile tools with machines that were thoroughly familiar to him—a better forge, a lathe driven by foot power, a drilling machine, and plenty of the best hand tools.

During his spare hours he could work on a "farm locomotive" that would do the farmer's labor. Winter time impressed one more than ever with the need for such an engine. The horses had to be fed every day whether they worked or not;

and the big haymows dwindled away. When summer returned a certain amount of time would have to be used in filling them up again.

On the Ford farm was some machinery. A mowing machine, drawn by horses, of course, was used to cut hay. Henry found an old one and from it got two big iron wheels for his "locomotive." Next, he had to build an engine. He made a pattern and cast a cylinder three inches across and nearly four inches deep out of metal which he had heated until it was molten enough to mold. Inside he fitted a piston which was to be moved up and down by the force of steam generated in an upright boiler.

Finally the odd-looking rig was all put together and fastened securely. Fire was started under the boiler, and slowly the water came to a boil. The steam pushed against the piston head; up and down went the piston; the big wheels began to revolve slowly. The vehicle traveled a distance of forty feet—and then stopped. There was not enough steam to keep it going, nor was it possible in such a limited way to make more steam.

The boy did not admit for a moment that his

dream was a failure. On the contrary, he felt that he had proven it. If the "farm locomotive" could travel forty feet, later one could be made that would go as long as was desired. Meanwhile it was necessary for him to learn more about engines. The trouble was with the boiler, he knew. Such a light machine could not handle a heavy boiler; and ever since his experiment with the kitchen kettle, he knew the danger of using a light boiler for steam. His thoughts turned to the farmer's wagon—perhaps an engine could be rigged up that would carry the farmer back and forth. Afterward the way might be cleared to a "farm locomotive" that would be practical.

So the boy went back to "school" to study engines. While working on his first job he had been loaned a magazine that told of a new kind of engine. The paper had been brought from England by a workman, and the engine it described was called the "Otto." The Otto had a single piston which was moved up and down by gas. The magazine had diagrams as well as a description of the engine, and from his study of them Henry learned that it was possible to make an engine run by something else besides steam. It

hardly seemed the sort of engine that could be adapted for a farm wagon, yet he studied it just as he did the proposals to use vaporized gasoline.

During one of his trips into the city to call around at the shops and learn what was new, he found an Otto engine that had been brought in by a bottling concern. The purchasers were having difficulty in making it run. Someone suggested that young Henry Ford could fix it, because he knew "all about gas engines." Henry did not deserve such a high reputation at that time, although he had studied them whenever possible. But he was willing to try to fix it. His reading and studying now stood him in good stead. Before long he had it running again. At the same time he decided that he would try out a new motor of this sort for his vehicle if he had to make one himself.

It was much more complicated than the old steam engine. Nevertheless, he set about building one with his own hands. One of the things he aimed at was light weight, and with this newfangled gas engine he felt it might be possible.

Seven years had passed since the day he walked into the city to begin his education on engines. Now he was a finished machinist, and he built an engine which, despite its increased complex-

ity, was by far the best he had constructed up to that time.

Meanwhile, like all other young men, he had found another interest in life—a girl. He met her in the fall at a big gathering of young folks held at his father's farm after the harvest had been completed. Her name was Clara Bryant, and she lived a few miles distant, far enough away so that he had never seen her before. She was more than ordinarily attractive, and the young blades of three townships were all seeking her favor. Henry was a bit late in joining the crowd.

He discovered that it was quite important to learn how to dance. During the long winter evenings dancing was one of the popular pastimes among the young people, and learning how to do it was much different from what it is nowadays. Each dance had its own movements, and many of them were performed in sets of eight, four boys and four girls. Present, of course, was a "caller," who issued the commands at the proper moment for each couple to do its steps. Music was furnished by a fiddle, aided sometimes by a sweet-toned instrument called the "dulcimer." Henry learned the more complicated dances, as well as the waltz, which was then just coming

in. Before long he was one of the best dancers in the township.

Another winter sport was skating. It was possible to go on the ice from his father's farm all the way down the River Rouge to its mouth, and then up the Detroit River as far as Belle Isle, a marshy island near the entrance to Lake St. Clair. The City of Detroit had purchased this isle for some two hundred thousand dollars for a public park, and the trip down there and back on the ice was an event to be remembered.

And then, of course, there was sleigh riding. Henry shone on the ice as he did on the dancing floor, but that was not enough. He had a cutter of his own, bright red in color and shod with runners that would enable it to glide swiftly over the snow. It was a beautiful piece of work and provided the means for many enjoyable rides by moonlight through the snow-drifted woods and along the country lanes.

Henry finally made something that really attracted the attention of the young lady. This was a watch that could keep two different times of day at once. It had two dials and two sets of hands. The reason for it was that a new time was being introduced, known as standard railway

time, which differed from the old-fashioned time of day by sun that was then used in southern Michigan.

This double watch both surprised and impressed the girl. Here was a young man who was not only able to do things, but was able to think. Most of the boys she knew could do ordinary things, some of them well, but none had the initiative to devise a thing like a double watch. Henry's stock took a sudden bound upward, but it was another year before he was able to lead the field and become the favored suitor.

CHAPTER IV

THE CITY CALLS

WHEN a young man looks forward to getting married it naturally sobers him a bit. He is going to have two persons to support instead of one, and he can't do quite as he pleases about quitting jobs in order to learn about engines. He looks forward to a little home where he and his sweetheart can be by themselves.

So for the time being Henry devoted himself to getting ready for marriage. It seemed to his father that the boy had forgotten the early dream of building engines. The hard-headed farmer was quite happy and told Henry that he could have one corner of the home farm for his own. It was forty acres in extent. Part of it was under cultivation and the rest of it was woods.

Henry tackled the forty with a well-formed plan in mind. By cutting the wood he could get enough lumber to build himself a house, and enough more could be sold to keep himself and

his bride. Meanwhile he would be clearing the land so that it, too, could be plowed. Clara was taken into his confidence, and they began to plan the cottage.

The youthful bridegroom rented a sawmill—or rather a portable steam engine to which he attached a circular saw—set it up, and soon had it buzzing merrily through the logs. As fast as he cut the boards he piled them up to season and turned his efforts towards splitting shingles for the roof. He hired a man to help him build the house, and before long the rafters were up.

The house was not a large one, although it was comfortable and just suited to a young couple who were setting up housekeeping. It was a story and one half high and thirty-one feet square.

When he and his bride moved into the new home Henry also moved his "machine shop" from his father's farm to his own. He continued to think about engines, and whenever he could find anything about them to read he studied it during his spare time. His young wife was almost as much interested as he, for she had come to admire and respect the determination and resourcefulness of Henry.

Henry applied himself strenuously to work.

Part of the time he sawed up lumber and sold it. He got a job during the summer months setting up and repairing farm engines for a harvester company. In the meantime he farmed, although he could not keep his mind off the many different ways in which labor and time could be saved if some sort of a machine could be developed that would replace the horse.

The difficulty was to find something that would take the place of steam in a practical way. He gave steam a final trial, making an engine of one cylinder in the shop behind the house and bolting it to the bottom of his buggy. He ran a belt from the engine to a shaft connected with the rear wheels, but encountered a stone wall when he tried to work out a boiler that would be small enough to fit the buggy and yet capable of generating enough steam to make it go.

But even then he was not ready to admit defeat. More education and more experience with engines were what he needed. There was only one place to obtain them—Detroit. But it would not be quite so easy as before to return to the city now. He had a wife and a home—and a farm to consider.

So he talked it over with the young lady. To

her it meant breaking up housekeeping in the little house she had come to love. They were very comfortable and happy there. It meant leaving her friends and the scenes of her girlhood. It might be a foolish mistake which they would regret later. But she felt confidence in her husband and in his dream. If he believed they should go into the city she was willing to go with him.

She told him so. Others, the neighbors and his own folks, threw up their hands in despair. The step seemed so unwise, just when they were getting nicely started. Henry ought to be old enough now to realize that his tinkering around with engines would never do him any good. Even if he did make one that would run, what would he do with it? No one would use it when the good old horse was so much cheaper and safer! His father felt that Henry was making the blunder of a lifetime. But nothing could change the young man. He went into Detroit to look for a job around engines, meanwhile putting up the farm for rent.

The city was now almost twice as large as it had been ten years previously when the boy walked in from the farm to seek his first job. It

spread out over nearly thirty square miles along the Detroit River. Many new factories had sprung up. The Pullman Company had come in with a plant to equip cars for the railroads according to a design invented by a man named Pullman.

Electric lights were now being used to such an extent that the Edison Electric Company had three plants, or substations. Telephones were recognized as a necessity rather than a mere expensive luxury. Downtown was a Nickelodeon with little peepholes wherein one could see motion pictures if one turned a crank on one side; or where by putting on ear clamps one could hear music that came through tubes from a queer-looking box called a "gramophone."

The whole world was moving forward, and Henry wanted to take his part in the procession. He looked up his old friends with whom he had worked at the machine shop, and one of them, who now toiled at a substation of the electric company on Willis Avenue, was finally able to get him hired to fill a vacancy that occurred about that time.[1]

[1]Henry was hired by John R. Wilde, who later became chief engineer of the Detroit Edison Company.

Henry was anxious to learn about electricity, for it rapidly was becoming an important source of power, and some people were even considering it as a means of making buggies and wagons go. The current used in Detroit was generated in the substations by steam engines, and among them young Henry was right at home.

With his wife and "machine shop" he moved into the city and rented a house on Forrest Avenue, moving later to Bagley Avenue, where in the back yard was a little old brick shed, just the place for his tools. He did not worry over the fact that his wages were going to be small or because he had to work twelve hours from six in the evening until six in the morning on a night shift. He was sure that he was on the right track: once more he was back among engines, where he could learn and where he could spend his spare time developing a mechanical "buggy."

It never occurred to him that he had already spent the greater part of ten years thinking of that dream, or that he would have to hurry. Nor did he feel that he had learned all there was to know about engines. At the electric company he would be able to study ways of creating a spark,

for he realized that an engine using power made by exploding gasoline would need a steady spark to ignite the gas. In those days the spark plug hadn't been as yet developed.

With his dream just as bright as ever and his purpose just as strong, he settled down to another ten years of study and experiment, feeling that in due time, if he toiled hard and faithfully, he would be successful.

CHAPTER V

AS THE TWIG IS BENT

AT THE time of his marriage Henry Ford was twenty-four years old, for he had been born on July 30, 1863, and was married in April, 1888. He was still in his twenties when he moved into Detroit with his little shop to follow out his dream.

As in the case of many great men, stories and legends have sprung up about his boyhood and youth, all to the effect that his life was different from that of other boys in that period.

One such tale has pictured him as a poor boy, the son of uncouth, uneducated parents, compelled to struggle against bitter poverty and countless handicaps. Nothing could be farther from the truth. It is true that he was born and raised on a farm, and that life on a farm in those days was always hard, with plenty of work for boys, as well as men. But he never wanted for food or warm, home-made clothes, and he had

plenty of time in which to play with other boys.

His father's farm was a large one, comprising more than two hundred acres of good soil not far from a growing city. Two hired men helped care for it. The farmhouse was comfortable. In the kitchen was a large fireplace, later a stove. At first this room served as living and dining room until other rooms could be added.

There were a number of outbuildings, a large barn, chickenhouse, corn crib, and so on, and a well-stocked orchard. In the woods were many different kinds of nut trees and varieties of berries.

Like other thrifty farmers, William Ford kept a herd of cows and obtained a steady revenue from the butter that he sold. There were sometimes as many as thirty hogs fattened and sold each year; there were horses and sheep. Near the house was a truck garden, and not far distant was the winding Rhulo Creek that emptied into the River Rouge.

His mother was a capable farmer's wife, looking after the many duties of the home and churning butter, caring for poultry, canning quantities of fruit and vegetables, keeping the youngsters in clothes. She was of sturdy Dutch stock,

calm eyed and cheery and more than ordinarily attractive. It was a terrible blow to the boy when she died—he was still a boy when it happened—for she had been a close pal to him and had guided him on the pathway of his dream.

Henry's first school days were spent in a little red brick school, the Scotch Settlement School, which he entered as a boy of seven. It resembled other district schools of the time: one large room with a wood heater, double desks of wood, a bad boys' bench, and a place up front for the competent man teacher. Reading, writing, and arithmetic, the three R's, were taught, and older students also delved into geography, mental arithmetic, and natural philosophy, the last-named a kind of general science course. They used spellers, of course, and the readers were written by a man named McGuffey. The McGuffey readers have now been set aside for more modern books, but they conveyed to the scholars of that day a broad view of literature and of right ways of living.

Henry's education was much like that of other boys of the time. He covered all the studies that were possible and besides did considerable reading. He did not care for works of imagination,

such as fiction, but he did like to read the lives of the world's great men. Washington and Lincoln were two of his favorites, and another was the Greek philosopher and teacher, Socrates.

Outside of school hours he played the usual games, "mumblety-peg," spinning tops, flying kites, leapfrog, crack the whip, prisoner's base, "one o'cat," and "pom-pom pull away." Then there was the old favorite, "ante ante over," tossing a ball back and forth across a roof. The old swimming hole was always a delight in summer.

Henry enjoyed making things himself with his own hands, first with a pocketknife, and later out of metal. The blacksmith shop held a strong attraction for him, and he spent many hours in the village watching the smithy, eager to help handle the tools or operate the bellows. It was here that he learned how metal was heated and forged.

Although he played and studied as other boys, he had one characteristic that was quite different. Like them, he asked lots of questions, but he didn't seem to be quite satisfied with the answers until he tested them and proved them true or false.

Of the many stories told of his boyhood, one

shows clearly how this trait developed. To-day, near his classic white stone experimental laboratory at Dearborn, lies an artificial lagoon on the spot where an old sawmill stood when Henry was a boy. All about was timber and farm land. The machinery of the old mill lay on the ground or in the sawdust, and every time he passed by he wanted to stop and investigate.

At last [he said, telling the story to Albert Sidney Gregg][1] I made up my mind to take the top off the steam chest and learn the secret of the slide valve. So I armed myself with a monkey wrench and went to work.

After I had the thing all apart I ran my arm in to locate the steam ports and find out how the valve controlled the steam. Just as I got my hand well inside, the sawdust caved in and the cylinder rolled over on top of me. There I was, caught like a bear under a deadfall, but not injured.

Fortunately, my arm was not broken or even wrenched. But I could not remove my hand unless I could turn the cylinder over, and I was not strong enough to do that without help. After studying the situation over for a moment, I thought of an engineering plan that might work.

With my left hand I reached around and dug away the sawdust on the other side and made a trench into which the cylinder finally rolled. It was a slow and tiresome task, but

[1] Interview in *Leslie's Illustrated Weekly*.

I had to do it. There was no other way of escape. As soon as I got my hand out, I went right ahead and solved the mystery of the slide valve in that old engine.

Another story indicates his early determination to shape his plans along manufacturing lines in a broad way. He studied his problems from the point of view of the multitude rather than from the narrow horizon of the farm or village or even the large city.

Watches were always a delight to him—at one time he owned nearly three hundred of them. They were a constant source of study, and after he had come to know them intimately it was but natural that he should consider making them himself. He went after the problem with all the earnestness of an eager boy and decided that if the parts could be made by machinery and in large quantities it would be possible to turn out good watches that would keep time at a cost of thirty cents apiece.

He proposed to build as many as two thousand a day and to sell them for fifty cents each. That was in the days before the dollar watch had made its appearance. Henry set to work designing machines; he cut dies for the parts. An-

other young man was enlisted in the scheme, and for a time it looked rosy. He finally decided that it would not be sensible because two boys could never sell two thousand watches a day, even if they could make them!

It was a wise decision for the boy, and it showed the trend along which his mind even at that early date was traveling.

CHAPTER VI

CHIEF ENGINEER

DURING all the time that Henry had been studying and thinking about engines, many others in different parts of the world had been working along the same line. One difference between him and so many others was that he was willing to wait and study until he had developed something which would prove practical. He was seeking, not something to startle the world as a seven-days' wonder, but a device that could serve men and lighten their labor.

A whole century earlier a native of Lorraine named Cugnot had built a heavy tricycle with boiler and engine mounted over the front wheel, with which to move the heavy cannon of the French. But it was a difficult thing to steer because the machinery all rested on the front wheel.

Later steam carriages were built both in England and in America. About the time of the Civil

War they disappeared from English roads, partly because the roads were almost impassable and partly because of the coming of the steam railroad, which had proved most popular. One law after another was passed to interfere with the steam automobile. The final blow came when Parliament compelled them to operate at a speed not faster than four miles an hour, and a man had to be sent ahead with a red flag, warning horses and people of their approach.

Others had worked on the idea of an engine which could use an explosive to drive a piston up and down. Gunpowder was tried, likewise hydrogen and illuminating gas. One of the best of the early gas engines was made by another Frenchman named Lenoir, who carried on his studies about the time of the Civil War. He used a spark plug which fired continuously and thus created so much heat that the engine was very inefficient once it got under way.

About the same time a German engineer named Otto was working on a gas engine which would allow time for the gas to be compressed in the cylinder head before the explosion took place. This became eventually the first "four-cycle" engine, four-cycle because the piston traveled

four times, twice up and twice down, for each explosion or power impulse.

That engine was taken by one of his men named Daimler and adapted to a vehicle. Later Daimler continued his experiments until he had constructed an engine that had four cylinders all in one line, but it was not for some years that the use of an automotive vehicle became widespread in Europe.

Meanwhile, others had been studying the use of electricity as a means of moving vehicles. Although the laws in England were still as strict as ever, an Englishman built an electric cab which was so satisfactory that it was placed on the market; and another made an electric omnibus that operated on the London streets under special license. One important drawback was the weight of the heavy batteries carried along to provide current, and the fact that they had to be recharged frequently.

The idea of the horseless carriage or wagon was simply that of an engine installed on a wagon or carriage frame. The whip socket was used to conceal the coil. The tongue of the wagon was the steering lever. Henry Ford's ambition was to make a new kind of car, one which would be

adapted to the needs of the machinery, rather than one which merely was a horseless cart.

Another American who was toiling over the problem was Charles E. Duryea. His first effort was to hitch a gasoline motor to four wheels, and unfortunately the motor was not powerful enough to turn them after the job was finished. So he had to start it all over again and did not complete it until a year later.

In that way others in different parts of the world were seeking the same thing that Henry Ford sought. All of them at that time were in an experimental stage, for the horse and carriage still commanded the streets. Henry alone seemed to vision the wide future awaiting the production of a successful vehicle, and he was content to study and go slowly until his product could be right.

He did not worry about the future.

My dream of making an engine never left me [he said later], but I did not merely sit down and dream. I worked and experimented. Whatever I have been able to accomplish is due more to hard, unremitting toil and perseverance than to any other factors.[1]

[1]Interview with Albert Sidney Gregg, *Leslie's Illustrated Weekly.*

Down at his place of work his knowledge of engines soon brought him to the attention of his bosses. When one of the machines broke down he seemed to know just what was wrong and how to get it started again. His willingness to get into the grease and oil, and his ability to toil long, hard hours, won respect and, with it, promotion.

One day the engines in the main plant broke down, and Henry was sent for. He showed his skill so clearly that the folks in charge decided he was too valuable to keep in the substation. He was brought to the main plant permanently and given an increase in wages to seventy-five dollars a month—a decided jump. When he went home with the glad news it was a happy occasion. He had proved that work was not without its reward, and soon now he would be able to get back to work on his "dream."

Once off the night shift he began using his evenings in the little brick shed on Bagley Avenue. Sometimes on Saturday nights he worked all night long. He had determined to try an engine powered by gasoline. Once he had the car all planned out, he had to fashion each part or find it somewhere. He had made up his mind not to attach an engine to a buggy. He proposed to

build a vehicle that would be adapted throughout to its own motor—in other words, a motor car.

That, of course, took money and required the sacrifice of time which other young folks were using to enjoy themselves. His wife was willing to sacrifice with him, for she believed in him. Neighbors looked at him as a sort of harmless crank who would never get anywhere and who probably would lose his job if he didn't quit fooling around.

His employers, however, were so impressed by his ability that they made him, nine months after he was moved to the main plant, chief engineer, at the enormous salary of one hundred dollars a month. In those days such a sum meant an excellent living. The young man easily might have considered himself a success. He might have been tempted to stop his night work and his sacrifices and drift on into a future that would be happy and secure.

But that would have meant giving up his dream.

CHAPTER VII

IN THE GOOD OLD DAYS

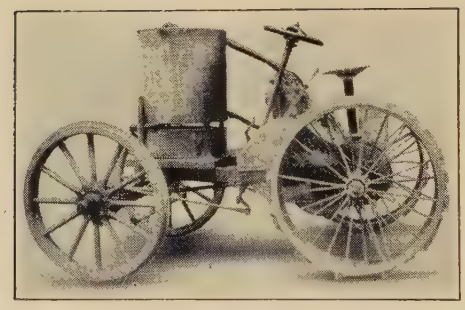
THE year 1893 brought with it the World's Fair in Chicago, celebrating the four hundredth anniversary of the discovery of America by Columbus. It was the greatest of the kind that had ever been held. Visitors came from all parts of the earth to view the progress made by civilization, and after doing so went home deeply impressed by the wonders they had seen. No one dreamed of the far greater development that was to come in the next few years with the advent of the motor car.

The cars displayed at the Fair were strange, awkward things. One was an electric; another was a "quadricycle." They did not attract much attention, for no one considered them practical.

Boys who have had the good fortune to live their boyhood in this first half of the Twentieth Century cannot remember when they saw their first automobile or took their first ride. Yet their

Birthplace of Henry Ford at Dearborn, Michigan. The old Ford homestead has been restored by Henry Ford and has been moved to the intersection of Ford and Greenfield roads near Dearborn, Michigan.

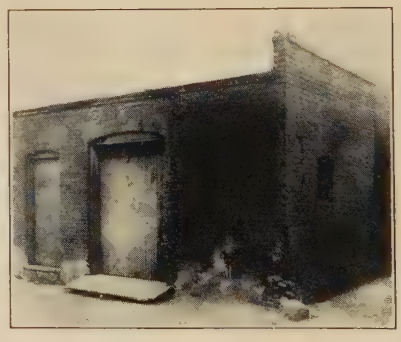
Henry Ford's present home on the banks of River Rouge near Dearborn.



AN EARLY FARM TRACTOR DESIGNED AND BUILT BY HENRY FORD

The upright steam boiler, the mowing-machine wheels in the rear, as well as the seat borrowed from the same machine; and the wagon wheels in front, are all plainly visible.

THE HOME OF THE FIRST FORD AUTOMOBILE BUILT IN DETROIT



In this brick shed in the rear of a house near Cass and Bagley avenues, Detroit, Henry Ford built the first automobile to be built in that city. When he finished it, he had to widen the door on the right so that he could get the car outside for its first trial.

dads can recall the first weird contraption that came to town and the first awe-inspiring ride. The machines went so fast that they took one's breath away!

You who are a boy in this present age can probably drive a car. You know more than your dad about airplanes and radios. You think nothing of going alone more than fifty miles from home. You cannot recall a day when there were no paved roads stretching across the country. Born into a world that is flying over the North and South Poles and across oceans; sending pictures by electricity; listening to concerts across great gaps of land and sea; studying forms of life that bring us close to its beginning; no doubt it seems to you that things were always like this.

Whether you are a city or country boy, you seldom see lamp wicks trimmed, glass chimneys cleansed or squat bowls filled with kerosene for the evening's light. You seldom see one replace gas mantles on chandeliers. Except in very remote districts, the electric light is commonly used throughout America. All you have to do is press a button or snap a switch.

Saturday night meant for your dad a session in a steam-clouded kitchen, sensuously warm,

taking his weekly bath in a round wooden tub with plenty of scalding hot water; or in a zinc-lined tub that was the only furniture in a new-fangled "bathroom."

For washing his hands he may have used "soft" soap that slipped through his fingers even as he dug it from a jar. Or, if he was fortunate, he could wash in soft water drawn at a little hand pump from a cistern, except during the summer months when the level got too low. And sometimes his folks sent away to Larkin's at Buffalo, where they bought a whole year's supply of soap at one time, and with it a gorgeous sitting-room lamp, an oak desk for Mother, or a library table with a special place at each end for books.

After dark, you are not afraid to be out on the street or country road. The arc lights in town no longer sputter in lonely grandeur over the center of each street intersection, to the zooming of great beetles. Your night lights glow freely and brightly as well as silently.

As you walk down a city or village street you do not stumble over loose planks in the sidewalk, nor stub your toe on projecting spike heads; neither do you scramble over broken bricks or

loose flagstones. Yet your dad dropped more than one penny through cracks in the sidewalk and had to crawl underneath to regain them. He can recall when wood planks or narrow stones, chiseled into rectangles, were laid along the street to form a curb. He probably spent several happy evenings where round cedar blocks were piled up, waiting for the morrow when they would be laid upon the street as paving. Possibly he thrust a long stick into a tar barrel and chewed a mouthful of the smelly stuff.

The thrill when Dewey won at Manila Bay; the anguish of soul as the battleship *Oregon* steamed all the way around Cape Horn to join the fleets of Sampson and Schley off the Cuban coast; the glow of pride at the charge of the Rough Riders on San Juan Hill—your dad felt them all. He was stunned when the news came of McKinley's assassination at Buffalo. One of his boyish heroes was the vice-president, who stepped into the breach, a magnetic chap who showed two rows of white teeth when he grinned, brandished a big stick, and shouted, "Bully!"

Of course, you have many pleasures that your dad did not know. Whether he lived in city or

country, he usually walked to school—one mile or five. Big concrete stadiums for athletic contests were almost unknown. Boy Scout and Girl Campfire groups were still in the future. Great playfields were, also. Golf was a game for only the very rich. He did not know the meaning of plus fours. And yet Dad knew where the trailing arbutus grew in springtime and where the squirrels hid their nests.

Fourth of July, Memorial Day, Thanksgiving, and Christmas were significant days to him—not occasions for athletic carnivals or automobile races. Each had its traditions. On the night of July 3d he tied a string to his biggest toe and dropped the string out the window so he could be roused at daybreak without wakening the family.

You might have smiled amusedly at the boy of twenty-five years ago standing on the front porch of some neighbor's house and turning and releasing a lever which, as it rewound, struck a clapper violently against a large silver bell. You would have enjoyed watching him as he earned enough money for his first bicycle. And you would have had a real treat if, with him, you could have hung around the kitchen door on

baking day and licked the batter in the big yellow bowl after the cake had been set in the oven.

Dad had many pleasures that you probably will never know. There was Buffalo Bill's Wild West Show, for example, with Colonel Cody and Sitting Bull, both in person; there was the round black football that he used to kick around the vacant lot near by; there was the little red-covered notebook wherein the corner grocer jotted down each item, all to be added up at the end of the month when Mother paid the bill and brought home a bag of peppermint sticks, perhaps a stick or two of horehound.

And Dad had many adventures that you will never know. He didn't have to bother with Stop-and-Go signals; he didn't know what a skyscraper might be, let alone have to ride in an elevator; it was not necessary for him to learn how to play bridge in order to spend an evening with the neighbors; nor was he suspected of having repressions or inhibitions when he looked pale around the gills during green-apple time.

In such days as those Henry Ford built his first motor car. He was able to buy four bicycle tires and the wheels to match, but he had to construct the engine himself by hand. It had two cylinders;

these he made out of a cast-off pipe that he bought from the electric company. Pieces of gas pipe were used for the hubs of the wheels.

He planned to have the power connected with the front wheels, but that idea had to be changed soon, for he found that he couldn't steer easily, and the rear wheels were not satisfactory as a rudder. So the power went to the back wheels and a lever was fashioned by which it could be steered. Next he had to find some way to cool the motor. That was accomplished by the installation of a water tank that permitted water to flow into a water jacket. The gasoline tank was placed under the seat, and the fluid entered the engine through a small pipe and a mixing valve. An electric spark set off the explosion.

The car sat low on its wheels. It was extremely light, only five feet long. Yet it could develop four horse-power and had two speeds: a high of twenty miles an hour, and a low, of ten. He regulated the speed by a lever in front of the seat. When it was shifted forward the car was in high, and when backward, in low. There was no intermediate speed and no reverse.

Such was the car he built with his own hands in the little brick shed back of the house at 58

Bagley Avenue. One rainy night, when he felt that he had finished his job as nearly as he could, he pushed it into the street and called to his wife that he intended to try it out. She came to watch the test, for both of them felt that at last he had succeeded.

She waited there in the dark while he turned over the motor. It sputtered, hiccoughed once or twice, sneezed, and then settled down to an unsteady pitt-putt that meant only one thing. The thing would run!

Henry climbed into the seat, thrust back the lever, and had the supreme thrill of feeling the car move under him. The wheels turned. His young wife ran along the walk under her umbrella while he tried it out. He drove it gingerly through the darkness for a couple of blocks and then brought it back home. He pushed it into the first American garage and went in to get some sleep. In fact, he slept all the next day.

That was the début of the first Ford automobile.

CHAPTER VIII

HENRY'S FIRST CAR

HENRY FORD was still in his twenties when he designed his first automobile. One can hardly imagine the excitement that followed when he took it out on the streets for the first time. Everyone turned to look at it; children ran after it; dogs barked at it; and horses pranced and reared when it snorted past. Many smiled at it amusedly, wondering that anyone could be so foolish as to waste his time tinkering with such a crazy contraption. Others became indignant that such a noisy, loud-smelling contrivance should be allowed on the public streets, frightening horses and generally creating a disturbance.

Some folks talked of arresting the young fellow who persisted in driving it around. They could not understand that the only way its builder could find out how to improve it, or what it needed to make it practical, was to drive it. He took it off the wood pavement and made it traverse dirt

roads; he sent it up hills and studied its ability to climb. One day he drove it for the first time all the way out to his farm. He arrived there safely, and the little home he had built with his own hands saw the motor car built by those same hands.

There were some who looked on the car seriously. Many wanted to find out what made it go and even to try it out themselves. Whenever they found it idle they tried to investigate, and finally Henry bought a lock and chain so that he could hitch it to a post when he left it, much as he would a horse. Crowds gathered about the car downtown each time it stopped.

The young man had no one to teach him how to drive, for he was the first man in town, if not in the whole country, to drive a car. There were no traffic rules to worry about, and he didn't have either number plates or license. When the threats of arrest became a bit loud Henry called on the mayor, who happened to be a friend of the young man.

"I'll look after you if you get arrested," promised His Honor.

That was America's first automobile driver's license.

Henry drove the queer-looking vehicle about the streets and over the roads—wherever they were passable—until he had covered at least a thousand miles. Almost every evening he would take it out and experiment with it. Sometimes a friend or fellow workman from the Edison Company went along. Usually, however, Mrs. Ford was with him. Thousands, as Henry said afterward, saw it.

Meanwhile things happened both in the Ford family and in the outside world. In November, 1893, a son had come into their home and was named Edsel Bryant Ford. Edsel had been the name of Henry's chum back in school—Edsel Ruddiman. The middle name, of course, was Mrs. Ford's maiden name before her marriage.

During the same year Elwood Haynes built a successful motor buggy at Kokomo, Indiana, and about the same time Duryea down East produced a two-cylinder motor wagon.[1] Up in Lansing, Michigan, a young man named Ransom E. Olds was working on the same idea, despite his father's disapproval.

Europe was several strides ahead of America,

[1]Elwood Haynes's first car is preserved in the Smithsonian Institution at Washington, D. C., and is credited as being America's oldest automobile.

because of the pioneer work of Otto, Daimler, and a Frenchman, Levassor. Levassor did not live to see the Motor Age in its full development, but he has been honored by a memorial that stands to his name to-day in France.

Levassor's ambition was to build a mechanical vehicle that would carry him once around the fortifications encircling Paris without compelling him to stop for repairs or accident. He had cut out a Herculean task for himself, and it took nearly two years to accomplish this run, which is now almost insignificant.

Levassor had at his command the experiments that Daimler had been making with the Otto engine, and he in turn refined it. One of the things he suggested was the placing of the motor in front of what was called the "dash" or "dashboard," much as the front of a buggy or carriage was called the "dashboard."

The French were particularly alert in developing the motor car. Most of the terms that now are commonly used, such as automobile, chauffeur, garage, chassis, and tonneau, were used originally by the French. By midsummer, 1894, there were fifteen cars in France enduring enough to race seventy-five miles from Paris to Rouen.

America's first contest did not come until one year later. The principal means of transportation in this country, outside of the horse and railroad, was the bicycle. During early morning and evening hours the main streets of the large cities were filled with steady streams of bicycles carrying people to and from their work. On Sundays and holidays the country roads were lined by pleasure seekers. Clubs were organized and made special runs. There were tandem bicycles on which two could ride, one behind the other; and there were long monstrosities on which as many as five or six could push pedals in a long row, all at one time.

Women cycled as well as men, and had special bicycles with guards over the rear tires to keep the skirts from entangling. They had tricycles with a small wheel in front and a lever handle with which to steer.

As Duryea, Haynes, and Alexander Winton began to manufacture automobiles for sale to the public the young Detroit inventor was left seemingly far behind. He was not satisfied with his first car, and he wanted to wait until he had a car that could be sold for a reasonable sum to ordi-

nary people before he went into the business himself. He felt that a tremendous field awaited such a car—literally the whole world. So he wasn't in any hurry.

While heavy, high-priced machines were being built and sold to rich people he sold his first car for $200 and set to work to make another.

Down at New York City an automobile, the Benz, which had been imported from Europe, was on display. It had something new on it, and so Henry journeyed down to look it over.

For fully two years he worked on his new car, seeking to make it lighter and stronger than the first. During that time he went East to one of the Edison Company's conventions at Manhattan Beach and there met Thomas Edison. Henry regarded Edison as the greatest inventor the world had ever known. The young, earnest-eyed worker from Detroit shook hands for the first time with the man who had given electric light and many other inventions to the world. It was the beginning of an acquaintance that later became a close friendship.

The second car was seven feet long instead of five, and it could go backward as well as straight

ahead. It was much better than its predecessor. Henry felt more sure of himself and his ability to fulfill his plans.

Soon he was forced to face another important decision—another crisis in his life. His employers felt that electricity was the coming thing and that the gasoline engine had little, if any, future. They wanted him to stop wasting his time over the gas engine and transfer his whole attention to electricity. If he did that, it would mean an assured future and a fine salary for him. His work had been so satisfactory that they were ready to make him general superintendent of the entire company. On the other side was something that as yet was little more than a dream. It was true that he had built a motor car and made it go, but just what the future might hold, or just how the thing could be used, was still very vague and uncertain.

As before, Henry did not hesitate. Against the advice of his father and all his friends, he resigned from the Edison Company and started out in earnest to make his dream come true.

CHAPTER IX

TRACK CHAMPION OF THE UNITED STATES

EIGHTEEN NINETY-EIGHT has been set as the date of the birth of the automobile industry, although prior to that time various men in different parts of the country, as we have seen, had started in the business. In that year the first Olds car appeared. In the next, Olds formed a company in Detroit and produced the first Oldsmobile, with curved dashboard and a tiller for steering. His car was immortalized in a popular song, "In My Merry Oldsmobile," which every boy and girl hummed with much gusto.

The automobile craze of the day was racing—speed. The first race of any importance in which automobiles took part in America was staged in Chicago in 1895, when the *Times-Herald* offered prizes for a contest between "motorcycles." The "probable winner," according to the *Scientific American,* was the Duryea motor wagon, which

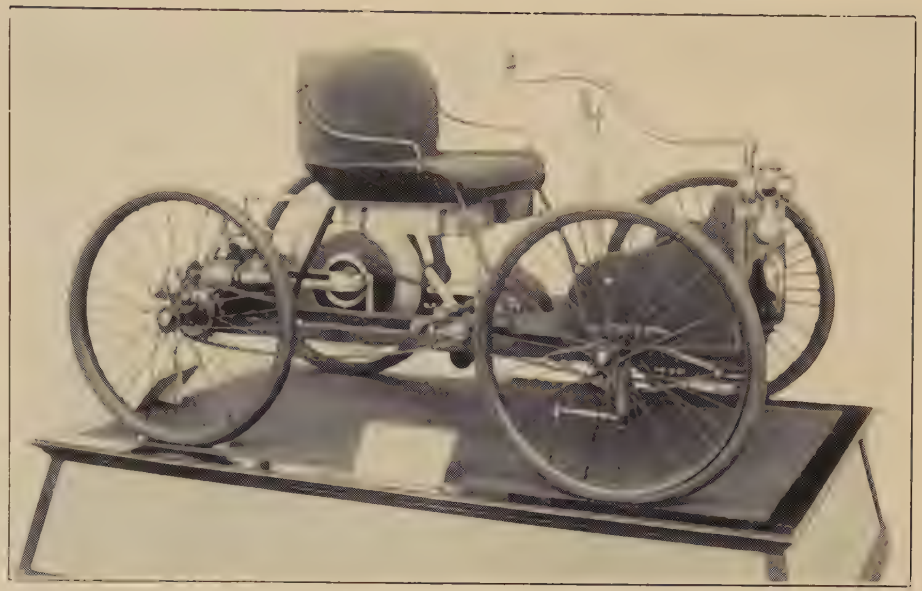
was awarded two thousand dollars, although the gold medal went to an electric car called an "electrobat."

Next, in 1896, the *Cosmopolitan Magazine* held a road race in and near New York City, in which six cars entered, four of them Duryeas. The latter captured first and second prizes. The judges included John Jacob Astor, Chauncey M. Depew, and General Nelson A. Miles.

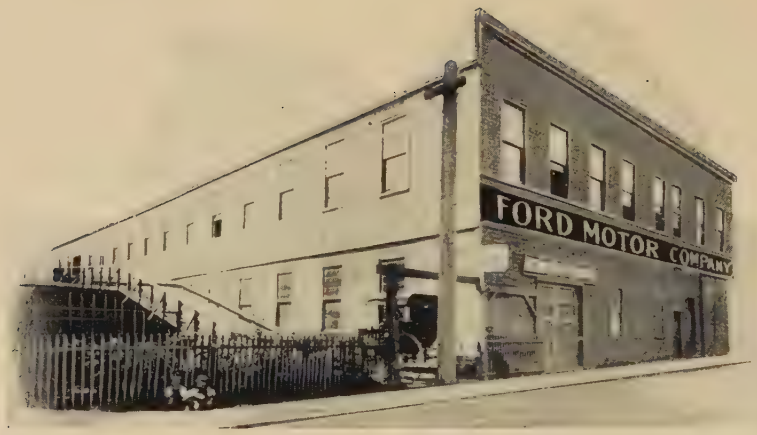
The number of American-built motor carriages offered for sale in 1897 was still "small," as the *Scientific American* said. The reason, it went on to explain, was the danger of trusting horseless carriages to persons who were not acquainted with machinery or were not friendly to the idea.

In spite of almost universal opposition, the business was slowly getting under way by 1898. Twenty-five firms were building cars—steam, electric, or gasoline propelled. About two hundred dealers were selling them, and in the whole country about twelve hundred cars were in use.

By the following year, when Henry Ford resigned from the Edison Company to start his own company, the names of Winton, Duryea, Olds, Haynes, Apperson, and Stanley, as well as several



Henry Ford's first car, the first built in Detroit and the second or third made in the United States. Note the bicycle wheels and headlamp, the buggy seat and the gong or bell on the "dashboard."



This is the first "Ford factory," occupied during 1903. Here the first "Model A" was assembled. The address was 81 Park Place, Detroit.

A touring car load of motorists visits the Igorrote village at the World's Fair, St. Louis, 1904.

others, were becoming widely known. Ford had hardly been heard of outside a circle of acquaintances in Detroit and Dearborn.

Various laws were passed to keep down the automobile. In Boston, for example, motor carriages were excluded from the parks between ten o'clock in the morning and nine in the evening, because of the many horse runaways that had been caused. In the same year, what was said to be the first automobile parade in America was held on Fifth Avenue, New York City. Thirty-four cars, one delivery wagon, and one motorcycle took part. As the chugging vehicles jerked their way from the Waldorf Astoria Hotel to One Hundred and Tenth Street, many fell out, and Fifth Avenue paused to laugh at the absurdity.

A motor "stable" was opened in New York City in June of that same year for the use of car owners. This was said to be the first public garage in America.

Such were the beginnings of the industry in which Henry Ford, now a man of thirty-six years, was entering. No one imagined—except possibly himself—its tremendous future. Bicycling was more widespread than ever. More than one mil-

lion cycles were being turned out each year by the factories.

Detroit was nearing the three hundred thousand mark in population. It was progressing, as well. In a downtown opera house an entertainment had been staged consisting of pictures thrown on a screen so rapidly that the actors seemed to move. The incessant flickering of the pictures and the noise of the lantern were said to be "quite distressing."

Ford's enterprise in building the first Detroit motor cars had brought him to the attention of various business men of the city who believed that with his ideas and mechanical ability and their backing, it would be possible to make some money. They organized the Detroit Automobile Company, put up ten thousand dollars, and made him chief engineer and construction manager. He was to get a salary of $100 a month and to have one sixth of the stock.

At first it seemed that he was on the high road to the realization of his dream. He worked night and day, harder than ever before, and tried to convince his associates that the car for them to build should be one for the common people. It was such a different idea from the one generally

held that they found it hard to agree with him. The cars that were selling in that period were the high-priced ones, such as appealed only to the rich.

One wintry day in 1900, when snow covered the Detroit streets, Henry invited a newspaper man to take a ride with him in one of the new cars. The invitation was accepted, and the writer had an adventure that he never forgot. Headlines appeared in the next Sunday's paper:

SWIFTER THAN A RACE HORSE, IT FLEW OVER THE ICY STREETS

THRILLING RIDE ON THE FIRST DETROIT-MADE AUTOMOBILE WHEN MERCURY HOVERED ABOUT ZERO

The ride began in the company's shop where the motor was first warmed up. When Henry got outdoors and began to speed up to twenty-five miles an hour, the reporter tried to climb out. Henry persuaded him to stay on board and showed him how the car was started without first applying a match to light the spark, and explained that it was entirely safe to sit over a tank of gasoline that actually held three gallons!

He also told the writer how to drive a car—one of the first driving lessons ever reported.

"There's little to learn. Ride a bicycle? It's the same thing. If you don't look out ahead, you may get into trouble. That is the secret of it. When you are running fast, you must keep your eyes open. Then you are perfectly safe. I have a speed regulator under my foot. If I lift my foot, it stops instantly. What more could you ask? She simply cannot run away!"

That same year the business of making automobiles really got under way. Olds made 1,400 machines in twelve months. A show, the first, was held in New York City for automobiles alone. For the first time, a gasoline car beat electric and steam cars in a free-for-all race. A new car, the Packard, introduced the steering wheel.

During the year Henry found that it was impossible for him to follow out his ideas with his new employers. Only about twenty cars had been built. Again he was faced with a decision—even more important than previous ones. Should he forget his dream and stay with his job, or should he break away just as he was getting nicely started? On one side was a position such as he had always wanted, that of chief engineer for an automobile company; on the other side was

his boyhood ambition, to make a car that could be used by everyone. The Detroit Automobile Company felt that such an idea was futile because the common people couldn't afford to buy cars. They insisted that their own policies be followed out in their company.

Again Henry did not hesitate. Even though he put himself out in the cold without a job or hope of one, and even though his friends were sure he was making a terrible mistake, he resigned his position, still true to his dream. All that he asked was that his name be not used by the Detroit Automobile Company in the future.

Meanwhile new cars constantly were introduced to the public; new firms entered the field; and it looked almost as if he would be left far behind. The company, after he quit, went right on making cars and was highly successful. Improvements were being brought out. A car appeared whose engine had four cylinders—the Peerless. Auburn, Cadillac, Studebaker, and Marmon came in the field. The name of Winton was on everyone's tongue.

Alexander Winton had won his first glory by taking a car abroad, and for the first time an

American car entered a foreign race. Everyone thrilled at his courage in competing against the older French machines.

Ford, undaunted by the rush of manufacturers into the field or by their growing fame, rented a shop at 81 Park Place and began working on a two-cylinder car of his own. He studied the handling of a business in all its details. The idea came to him that if he was to call the public's attention to a Ford car, he must do something startling.

So he selected the best-known racer of the time and set to work to build a racing car to compete against him. It was a daring thought because he had never driven a racing automobile in all his life. But his knowledge of mechanics and designs helped him a lot, and he built a two-cylinder engine that was light and had both power and speed. Next he challenged the great Winton himself to a race.

Winton accepted. It was just another race to him, although to Henry it was the biggest event of his life up to that time. The day set was the first meeting of the Detroit Automobile Racing Association, October 10, 1901. It dawned dark and gloomy, with storm clouds rolling in from

the Northwest. Despite the inclement weather a parade was held in the morning, with sixty-eight vehicles in line. Early in the afternoon the sky cleared, and fully eight thousand persons gathered at the Grosse Pointe race track.

Several preliminary races were held—one mile, five miles and ten miles. Among the winners were such notables as Edgar Apperson and W. T. White. Finally the track was cleared for the main event, a championship race over ten miles for machines of all weights. Winton and Ford were the only two entered.

When the machines lined up, Ford's car, awkward looking and crude, made a decided contrast to the smart Winton racer. The latter had fully forty horse power while Ford's was capable of about twenty-six.

During the first seven miles, Winton held a lead of about half a mile. Then Ford slowly drew up, passed his rival and at the finish crossed the line a mile ahead. His time for the ten miles was thirteen minutes twenty-three and four-fifths seconds. According to newspaper accounts, he could not cling to the inside of the track at the curves, and hence was forced to shut off power and coast about two fifths of the time.

It was "some race," as Ford has said, the climax of a big day for him. His name was on everyone's lips, and people marvelled that he had won the race with a car he had designed and built himself. But Henry did not care for racing. Except for advertising, he could not see how any good was accomplished by it. However, he believed that his car was capable of making a mile a minute, and he made up his mind to go out sometime when the track was clear of other vehicles and see whether he was right.

Meanwhile, by defeating Winton, the Dearborn farm lad for a time at least was track champion of the United States.

CHAPTER X

HIS OWN COMPANY

DURING all the next year Henry Ford worked in his shop and studied the automobile business. Early that spring an automobile show was held in Detroit—the first in that city—in which appeared a new entry, the Henry Ford Automobile Company.[1] But the "company" was not a success. It dissolved shortly because of the insistence of Henry's associates that the "company" build expensive cars only.

A frequent visitor to the shop was a coal dealer named Alexander Y. Malcolmson. Ford had bought coal from him while working for the Edison Company. Malcolmson had a bookkeeper named James Couzens, who also met Ford during one of these calls at the coal office. Like his boss, he became interested in the earnest chap from Dearborn. Malcolmson began to hint at

[1]The company was incorporated November 23, 1901. Its paid-in capital was $38,000 of which Henry was credited with $10,000.

starting a company in which he, too, could have a part.

Ford needed money, and Malcolmson could raise it. He knew of a carpenter shop owned by a man named Albert Strelow on Mack Avenue near the coal yard. It could be remodeled very easily into an automobile "factory." The rent would be $75 a month.

Henry went over to look at the place and figured out various alterations to adapt it better for the assembling of automobiles. These could be completed and the building ready for occupancy some time in June, 1903. Plans for the new company began to take on definite form.

Meanwhile other manufacturers went ahead rapidly. Olds built 2,100 cars in 1901 and beat that by 400 in 1902. The day of the one-cylinder engine had definitely passed. The motor and "water cooler" were becoming fixed in the front of the car "nearly over the front axle," instead of in the rear. Winton brought from France a "spark advancer" which would be a "great help to the motor when more speed was wanted."

The day of the single-tube tire was also waning, and so was that of solid tires for automobiles. Owners organized clubs for themselves in

which dues were as high as $50 a year. The automobile "lamp," burning kerosene, was coming into use, as was the "automobile repository" or motor stable. New York City had one which never closed, night or day!

Henry kept working in the Park Place shop on the car that was to be the first placed on the market under the name of the "Ford Motor Company." It was to be Henry's contribution, a light, simple, efficient car that could be sold for less than one thousand dollars.

For it he was to receive 255 shares of stock, representing $25,500. Only one other man would own as much stock—Malcolmson. The latter was to guarantee the bills of the company up to $3,000. (This swelled to $7,000 before the company got under way.) Henry was to be general manager and chief engineer at a salary of $200 a month.

When Henry finally finished the car, it was early fall. Everything was kept under lock and key so that information might not get out about it too soon. Blue prints, drawings, and papers were carefully guarded. More than fifteen different parts were patented. Automobile experts and cycle journal representatives from all over the country were given a confidential exhibition,

and they declared "it was superior to anything that has been designed in the way of an automobile."

It was to be a sturdy car. Its motor was designed for two cylinders, powered by gasoline. The car was six feet long, rated eight horse power, and was supposed to make thirty miles an hour. Two persons could ride in the seat; or four, if a tonneau was attached.

Three employees besides Henry toiled in the little shop on Park Place near Grand River Avenue. Gus Degner was the "mechanic"; John Wandersee was the general handy man; and a young fellow named C. Harold Wills was foreman and draftsman. Wages were less than twenty-five cents an hour.[1]

After the car was officially approved, the next problem was how to start its manufacture. Money was needed. So were parts, lots of them, costing thousands of dollars. About that time two brothers named Dodge, operating a machine shop in Detroit, were considering requests from various manufacturers to build parts for automobiles.

[1]Degner and Wandersee were still in positions of importance in the Ford organization in 1929, after twenty-five years of service. Wills resigned some years previous to market a car under his own name, the Wills-Ste. Claire.

Companies grew so rapidly in those days that any one of these orders would have tied up the entire Dodge output for months ahead.

Along came Ford with a proposal for them to make parts for 650 cars to be delivered at the rate of ten cars a day from July 1st to October 1st, 1903. Ford offered to pay for these on a basis of $10,000 cash, the balance after the cars had been sold. As their part of the bargain, the brothers were each to take fifty shares in the new "Ford" company, an investment of $5,000 apiece.

The deal looked good to the Dodges although it involved quite a gamble. They would have to tie up quite a sum of money in automobile parts. And they might never get it back. When at last they accepted, it was largely because of their confidence in Henry himself. Once committed to the project, they began to get the machinery together to make the parts. They had eight months in which to prepare, for this was in the autumn of 1902.

The rest of the car, body, cushions, wheels, and tires, all were to be supplied by different manufacturers. These parts were to be collected in the shop on Mack Avenue and assembled there into "Ford" cars. The "company" was to be control-

led by Henry and Malcolmson jointly. Each was to have 255 shares, and their holdings, added together, would total 510 shares, more than one half.

The capital was fixed at $100,000: 1,000 shares at $100 each. The problem was how to interest buyers in what remained after the hundred shares for the Dodges had been taken out.

The bookkeeper, James Couzens, was able to scrape together $1,000 and gave a note for $1,500 more, entitling him to twenty-five shares. Of these one was given by him to his sister. He was to go with the "company" as its office man with the title of "secretary treasurer."

Malcolmson talked with his banker and his lawyers. The latter were employed to draw up the papers for the new "company" as well as the contract with the Dodges. The banker finally agreed to put in $10,500 and the lawyers $10,000. Woodhall, Malcolmson's bookkeeper, signed up for ten shares. Strelow, the shop owner, took fifty. Two other men agreed to take fifty shares each. That made the thousand; but of the total capital only $28,000 was actually paid in as cash.

During those days of persuading people to plunge by investing their money in the "com-

pany," a sensation was needed to convince them that the "Ford" car would not be a failure, as had been so many others. Speed was still the big craze of the hour. People read in the papers about the thrilling rides made by fast cars and marveled at the daring of the drivers. Ford set out to make a racing car that would beat everything it ran against. Such a feat would make excellent advertising.

In order to be sure of success he built two cars instead of one. He gave each of them eighty horse power. A big engine sat up in front, with four great cylinders that roared tremendously when under way. Flames flared out behind. A two-handed tiller steered the car. The seat would hold only one person. Ford named one the *Arrow* and the other *999,* after a famous railroad locomotive.

The 1903 spring races at the Grosse Pointe track near Detroit were about due, and Ford planned to enter one of his cars. But he had done his job so well, they attained such terrific speed and roared so lustily that even Tom Cooper, a well-known racing driver who had been helping Henry, hesitated to drive them. Cooper knew of a professional bicycle rider in Salt Lake City

who "lived on speed" and wired his friend to come East to Detroit. In a short time this man, Barney Oldfield, arrived.

Oldfield had never driven an automobile, but he liked speed and within a week had mastered the *999*. The race was to be on a three-mile circular track with many unbanked curves. On the day set, the *999* took its place among the other machines, Barney at the tiller. Henry cranked the car for him, and as it started off, Barney didn't know whether he would come back alive. But he was absolutely fearless. He did not try to shut off the engine on the curves. He simply let the car go as fast as it could. He beat the next car by more than half a mile.

Later that spring Barney took *999* into the East, and on Decoration Day at Yonkers, New York, made a new record for one mile: one minute one and three-fifths seconds.

The showing made by *999* had the desired result. Ford was recognized everywhere as an automobile designer of skill and courage. On June 16th the Ford Motor Company, with $28,000 in cash and Henry's Model A as its total assets, came into existence.

Its purpose, as Henry described it, was to build "a motor car for the multitude."

"It will be large enough," he said, "for the family, but small enough for the unskilled individual to operate easily and care for, and it shall be light in weight that it may be economical in maintenance. It will be built of honest materials —by the best workmen that money can hire— after the simplest designs that modern engineering can devise. But it shall be so low in price that the man of moderate means may own one—and enjoy with his family the blessings of happiness spent in God's great open spaces."

CHAPTER XI

BREAKING A WORLD'S RECORD

THE summer of 1903 found Henry, on his fortieth birthday, in charge of his own company and building his own Ford car at last. The long years of preparation and effort had finally brought him to his goal. Now he worked harder than ever, both night and day. The remodeled carpenter shop on Mack Avenue, now a "factory," was crowded with parts and machinery. Orders came in faster than had been expected. One dealer in Buffalo alone asked for twenty-five cars.

Money was none too plentiful. The company had to carry so much material on hand that often it had to scrimp to meet the payroll. The first cars shipped were taken to the railroad station by Henry, aided by Wills and Jim Couzens, boxed up and sent away to Indianapolis, Minneapolis, and St. Paul.

Then came a bolt from the blue. A notice ap-

peared one day in July in the Detroit newspapers signed by twenty-seven of the leading automobile manufacturers of that day. It announced that they would prosecute any manufacturer who was not a member of their association and would sue any owner who bought a car from a company which was not a member.

Ford himself was told to join the association or it "would put him out of business." This association had been started four months earlier, and it now included most of the important automobile companies. Its members had agreed to pay, on every car built by them, a royalty to the Electric Vehicle Company, an Eastern concern which had secured the rights to a patent granted to a man named George B. Selden. Selden had drawn a plan for a horseless carriage back in 1879 and had obtained a patent on it in 1895.

The idea of giving in to such a proposition did not appeal to Ford at all. In the first place he had developed his own car independently and had never heard before of the Selden patent. He claimed that he had built his first car even before the patent was granted and that he had constructed it on a different idea from that which Selden had devised.

The Ford Company did not have any money to pay out for a "license," nor did he feel like joining an association which would be able to tell him whether he was to build cars, how many he could make, and what price to charge. Nor did he want to pay into a fund fifteen dollars on every car he made, of which a part would go to the association and part to the Electric Vehicle Company.

On the other hand, if he refused he might be stopped from making cars altogether just when he seemed to have achieved his dream. The Vehicle Company had already gone into court and its claims to the patent had been upheld. If he stood out against it he would have to fight almost the entire automobile industry of that time, which had now grown quite powerful.

So many manufacturers had joined that everyone would think him foolish if he persisted in staying out. They would laugh at his stubbornness, and right at the very outset of the company's career he would be branded as a crank, as queer, or worse.

Ford thought over all these things—and decided to fight! He had little with which to fight, but he felt that he was right. Armed with that

conviction he determined he would go down with colors flying before he would give in or join any combination.

So he picked up the gage of battle and went right ahead building cars through that first summer. When fall came his company and his New York dealers were sued by the Electric Vehicle Company and Selden. But even after the suit had been filed in court he didn't stop. Neither did he give in.

On October 1st Couzens got out a sheet of paper and pencil, to figure up the result of the first three months' business. Everyone was surprised at what had been accomplished. The sales of cars had brought in $132,481.72, and the net profit was $36,957.64. A first dividend of two per cent. was declared.[1]

A few newspapers and trade journals carried advertisements which described the Ford car. In them Henry told the world about the sort of automobile he wanted to build—still faithful to his dream. It was to be especially made "for everyday wear and tear." Its low price was ar-

[1]During the year 1903 Peter E. Martin and Fred L. Rockelman went to work for Ford. After twenty-five years of service, Martin in 1929 was vice president of the company and Rockelman was director of sales.

ranged to "place it within the reach of many thousands."

By now his salary had reached $300 a month. As frosty weather came on, sales dropped almost to nothing, for in those days winter driving was anything but enjoyable. Snow blanketed Detroit. Lake St. Clair near by was frozen over. At the factory plans were under way for a new model, the "B," a four-cylinder car of twenty horse power and a road speed of forty miles an hour. It was to sell for $2,000 and was a touring car rather than a runabout. Henry designed it at the request of his associates, who felt that the company should not confine itself to a light, inexpensive car.

In order to keep the company before the public Henry rebuilt the *Arrow* racing car and announced that he would try to break the world's record for one mile, on the ice of Lake St. Clair. A four-mile track was laid out, and January 12, 1904, was set as the date for the attempt.

On the evening before, Henry and Mrs. Ford and their son Edsel, now nearly eleven years old, went out to the lake. Next morning the racing officials, who had come from various cities to serve as judges and timekeepers, arrived. So did Jim Couzens.

The car was to be brought out from Detroit by workers from the factory. Early in the morning, the men tested the engine for the last time, only to find that something had gone wrong. They spent an anxious two hours looking for the difficulty before they corrected it and were ready to leave on the ten-mile journey to the lake.

It was a cold, blustery day, with a fierce January wind that cut through the thickest clothing like a knife. Henry kept warm in a coat of black astrakhan. After the car finally arrived he took his seat, the pistol cracked, and he was off like a rocket.

As he got under way he found that the ice which had seemed so smooth was really full of fissures. At each fissure the *Arrow* leaped high into the air and came down with a crash. Skidding, bumping, and holding to the wheel like grim Death, Henry completed the mile, to find that he had broken the world's record!

He had traveled at a pace of ninety-two miles an hour and had set a new fast time for the mile of thirty-nine and two-fifths seconds. The record, as he has since said, "went all over the world."

As 1904 opened, the company, along with the Model B, had made several minor improvements

in the A and offered it for sale as the C. Still another model was under way, the F, a touring car with larger cylinders than the A or C. It was to sell for $1,000, later $1,200.

The automobiles of that day, while greatly improved, of course, still were clumsy and uncomfortable. They still lacked many of the things that go to make motoring a pleasure to-day. Windshields were in the future. "Rain aprons" were used to keep mud and rain from passengers in the back seat. Such tops as were used were either flat or like those of the old-time buggy.

Flat tops were permanently fastened to the sides and back of the car with upright posts. Side curtains were rolled up inside and strapped to the top. The buggy tops were collapsible and had many braces and jointed elbows.

The craze for speed was reaping its harvest. As autoists drove past, boys and even men threw rocks at them. Tin cans, decayed vegetables, and sticks were sometimes hurled. Farmers were especially enraged because of the many runaways. They tied their horses along roads used by motor cars, to acquaint the animals with the smoking, noisy terrors.

As drivers began to venture farther from home

they usually got lost on unfamiliar roads. Then the chance came for the farmers and villagers to get even. They took special delight in misleading the motorists. One of the trade papers of the day printed some samples of road repartee. One follows:

Autoist: Where does this road go to?
Farmer: Nowhar; stays right whar it is.
Autoist: Where will I get if I go along it?
Farmer: You'll get to the end if you go far enough.[1]

When the Automobile Association of America, composed of owners, met in New York City in November, the members expressed their appreciation of the personal attention given by Police Commissioner McAdoo to the stopping of the "highly dangerous practice of stone-throwing."

[1] *Road Motor Magazine,* October, 1904.

CHAPTER XII

THE FIRST YEAR

THE first Ford car had one big selling point. Although it had two cylinders instead of one, it had less parts than any one-cylinder car built. Simple design, so simple that the average person, even though not a mechanic, could run it, was Ford's aim. In his later cars he never got away from this idea.

Soon after Henry had made his record on the ice in January, 1904, more people began to ask for Ford cars. A store of some kind was needed in which to handle customers, to be used as a sales and service station. Quarters were rented on Jefferson Avenue, Detroit. These became the first "branch" of the company.

As spring came on and the weather grew warmer orders piled in with a rush. The old carpenter shop on Mack Avenue had long since been found too small. From three men the force had climbed to three hundred.

Henry had tried to get the owner of the shop

to build on a second story, but the latter couldn't see his way clear to do it. When he refused, Henry took the bull by the horns and added on a second story by paying for it with company money.

For a short time this new space relieved the congestion, but only for a short time. Everything was so crowded that efficient work was hardly possible. The Mack Avenue shop could never expand enough to keep pace with the business that was ahead.

So, in May, Ford arranged for the construction of a new factory at the intersection of Piquette and Beaubien avenues, in Detroit across town. It was to be of brick and three stories high. There would be plenty of room for the company for all time to come, it was believed.

Nineteen four was the year of the World's Fair at St. Louis. "Meet me at St. Louis, Louis, Meet me at the Fair," a popular song, was sung in the East and in the West. Motor cars occupied a great building for the first time, all by themselves. The first car that Elwood Haynes had built was shown as a relic of the days ten years previous. Henry decided that the Ford Motor Company should join the ranks of the exhibitors and sent down the Model A, with a chassis.

During that summer the suit against Ford for infringing the Selden patent was pushed by the opposition harder than ever. In June the Association made a rule that any dealer who sold cars made by Ford or any other manufacturer outside its ranks could not handle cars made by its members.

The taking of testimony in the Ford suit started the next month. Henry himself was called to the witness stand to tell how he built his first car. Others told how boats, street cars, and even an omnibus had been operated by internal combustion engines at a date earlier than that on which Selden applied for his patent.

Meanwhile, Henry was planning another important step. It was the starting of a factory in Canada across the Detroit River from Detroit. It would mean the forming of a new company, the Ford Motor Company of Canada, Limited. By that move, it would be possible to build Ford cars for Canadians by Canadians in Canada, out of Canadian materials.

The new company was launched in August with a capital of $125,000, which was larger than that of the original company. A little red wagon factory was rented. Sixteen men were hired, three

of them for the office. The power was to be supplied by a plant of seventy-five horse power. The only machinery was a drill press.

As summer drew to a close, Ford sent out a Ford racing car to compete against other fast machines in different sections of the country. It looked so tiny alongside the big cars that many times spectators broke into a roar of laughter when it lined up. The laughter changed to enthusiasm as it came in first, time after time.

The driver was one of Henry's men named Frank Kulick, who had gone to work for him during the preceding year.[1] At Grosse Pointe, at Narragansett Track, Providence; at Poughkeepsie, New York, and at Albany, he set new records and won much fame for the Ford car.

Henry and Couzens figured up results at the end of the first business year which was set for September 30th instead of June 16th, the company's birthday. A total of 1,708 cars had been made and sold. The amount of business done had actually passed the million-dollar mark. It was $1,204,317.83. The profits were nearly a quarter of a million!

[1]During 1904 a pattern maker named Charles E. Sorensen entered Ford's employ. In 1929, after twenty-four years of service, Sorensen was general manager of the company.

Two days later the company announced in the *Automobile Review* the models B and C. The former with its twenty horse power and weight of only 1,710 pounds was said "to have more power for its weight than any car in the world." It was the first four-cylinder Ford car. Model C still held to two cylinders.

Other car builders were bringing out new models. A clumsy windshield had been devised and was being sold. The number of cars shown at New York City in January was more than one hundred and sixty, but of these only eight were electric and four steam. The rest used gasoline. The day of the steam car was passing rapidly.

Ford exhibited his three new cars, the B, C, and his two-cylinder touring car, the Model F. Two features of the Model B were new to the automobile world, attracting much attention. One was a "universal globe joint," the other was the use of two strong rods from the frame back to the rear axle. Another feature, almost new, was the use of side doors to get in and out of the tonneau, rather than one in the rear.

That was the last show in which the "unlicensed" manufacturers were allowed to take part with the others. After it was over the Asso-

ciation announced that it had leased Madison Square Garden, where the shows were held, for the years 1906 and 1907, and "only licensed" companies could use it during those years.

One result was to bring together the "unlicensed" manufacturers into an association of their own. A meeting was held at the Ford offices March 3, 1905, and headquarters were set up. They called themselves the "American Motor Car Manufacturers' Association." James Couzens was chosen chairman of the management committee.

During that same winter considerable racing was done on the Florida beaches. Henry went down to watch the fun, as he had a car entered in some of them; and while there he kept his eyes open for new ideas. A French racing car was wrecked not far from where he stood one day. He picked up a valve stem and, since no one could tell him what it was, sent it back home for analysis, to learn what kind of steel was being used. He was on the lookout for an alloy or combination that would give more strength and at the same time lighten the weight of the car. Ordinary steel had many shortcomings.

His men found that the French car was using

a new steel which was indeed lighter as well as stronger. It was called "vanadium." He resolved to experiment with it to see whether it could be used in making Ford cars.

Those were strenuous days for automobile owners. A good example could be found in the City of Chicago, where an ordinance compelled all cars to carry number plates five inches high while traversing the city streets. In each of the three park centers, Lincoln, South, and West, separate rules governed and different number plates had to be displayed.

On the city street, the driver was compelled by law to use a bell or gong when approaching a corner and whenever else it was necessary. On the North Side, he could not make any warning sound whatsoever, nor could he allow his car to emit any smoke or offensive odor. His city number plate was useless, for he had to have a special number and license tag.

On the South Side he had to have another number on the rear of his car. On the West Side, still another was required. These four license plates with different numbers made identification difficult, even for park policemen.

In Central Park, New York City, the Auto-

Horses became so frightened at the "horseless carriage" that a form of "introduction" was devised, in which the horse was led up to the automobile and allowed to become acquainted with it.

The advance of automotive travel, as pictured in a magazine of 1905.

HENRY FORD AND JOHN BURROUGHS IN THE ORIGINAL FORD CAR

mobile Club tried an interesting experiment. Officers arrested so many motorists for speeding that the club officials measured off a course and hired timers with watches to time the speed of horses driven there. These men brought in the horrifying report that the average speed of the horse-drawn vehicle was 12.28 miles per hour, which was 50 per cent. in excess of the legal limit! And no arrests of horse-drawn vehicles or their drivers were being made!

St. Louis had a law requiring all drivers to carry oil drip pans beneath their cars. It was feared that the dripping oil would damage the asphalt! An automobile dealer refused to comply and was fined $100.

CHAPTER XIII

GETTING CONTROL

IN SPITE of the fact that Ford had three models to offer during 1905, sales were a disappointment. They totalled only 1,695 cars during the twelve months as compared with 1,708 during the fifteen and one half months between June 16, 1903, and September 30, 1904. The amount of business done had grown almost to two million dollars, and the profits were close to three hundred thousand dollars. In other words, while the company made more money and employed more men, it sold less cars proportionately per model.

Ford believed this to be an unwise policy. It did not accord with his idea of cars for everybody. His associates did not agree with him, and he followed their advice for another year, waiting patiently until the time when he could get control of the company himself.

As 1906 opened, the "unlicensed" manufacturers put on a show of their own in New York City, about the same time that the association show was being held in Madison Square Garden. Ford had a new model ready, the N, a low-priced runabout. It was the logical successor of the A and C. Ford also had another new model ready, the K. It was a touring car of six cylinders. Another touring model that was still being sold by him was the B, which still held to four cylinders.

The last two cars had been Ford's concession to his associates. The N represented his ideas, and it was a star attraction of the show. It was late in reaching New York, but after it entered the display it became the center of a crowd continuously until the doors closed.

It was his first runabout to have four cylinders, both the A and C having had two. It was priced so low as to be startling—$600. An automobile writer declared that "this car will have an important effect on the runabout market this season."

During all this time the suit against Ford on the Selden patent was still being pressed, though not so vigorously as at the outset. The association warned car buyers not to buy "unlicensed cars."

Hints of trouble and lawsuits if they did were made.

The Ford Company replied to these warnings in advertisements of their own. The case had not yet been decided, they said, and no one could yet say that Ford was wrong.

Ford claimed that a car built according to the Selden patent wouldn't run. So his opponents built a Selden car, which scrambled and jerked about the streets of New York. But it was not a practical automobile.

In return Ford built a car of parts older than 1865, modeling it after Lenoir's ideas.[1] That car also ran around the streets of New York.

So the battle went on merrily between the "licensed" crowd and Ford. It was a busy, hard year for him, for the business was not making progress. The big models prevented him from going ahead with his idea of building an ordinary car in such numbers that every person could buy one.

The number of cars sold had actually dropped below that of the second year. It stood at 1,599 for the third year. The amount of business done had also dropped. The profits amounted to little

[1]Lenoir, see p. 43.

more than one hundred thousand dollars. This was all in spite of the fact that more than eight hundred people were employed.

Something radical had to be done. Ford decided that he must secure enough additional shares of stock to get control of the company. That meant buying out Malcolmson. Malcolmson had many outside interests, but he felt that his investment of $7,000 in the Ford Company had been a wise one. He set a value on his stock of $175,000.

Such a sum of money was staggering. It was almost twice as much as the year's profit. But Ford had faith in his idea, great enough so that he was willing to borrow money and give notes for it in order to raise the money to buy out Malcolmson.

To many it seemed an insane thing for him to do. The Selden patent suit still hung fire, and if that was decided against him he would lose everything. The money he paid out—his borrowings and the sums he had saved—would be swallowed up. His business would be ruined. But failure either in the lawsuit or in business didn't worry him at all. He still clung to his idea. He still had faith.

So he bought out his old friend and became master of the company. Malcolmson's 255 shares, added to his own, gave him 510, or 51 per cent. At this time Henry was forty-three years old. Twenty-six long years had passed since he had trudged into Detroit to learn about engines.

After he got in the saddle, he immediately put his ideas into effect. Some of the other smaller stockholders wanted to sell, and Ford with Couzens bought their stock, so that Henry had 58½ per cent. The new plant at Piquette and Beaubien avenues was ready, and the company moved in. It was one of the most complete of the kind in the country, and had been all paid for out of the earnings.

One of the first things Ford decided upon was to push the low-priced runabout during 1907. The Model N, followed by the R and S—all runabouts—were sold. The wisdom of his decision was demonstrated when at the end of the business year, September 30th, a total of 8,423 cars had been sold, more than five times as many as in the previous year.

The amount of business done was more than five and one-half million dollars. The profits had jumped to more than one million dollars. The

company had 1,427 men at work, and its shops covered more than two acres of ground.

That was a great convincing triumph for Henry and his faith. Confident that he was on the right track he determined to build the car of which he had always dreamed. He selected a little group of men and placed them in a designing room where they could begin work on his plans.

Ford was sure the car would be a success. In order to have space wherein to build it, he looked about for a larger factory site—even larger than that at Piquette and Beaubien avenues. He found it in the village of Highland Park north of Detroit. Here he bought sixty acres of ground, plus a mile track for testing cars. Here he proposed to erect a plant that would be big enough to turn out cars enough for everybody.

For one thing, the new car was to be made of vanadium steel. Ford had solved the secret of the valve stem he had found in Florida. Since the day he had picked it up at Palm Beach he had tried to get some steel maker to manufacture it for him. None could, so he sent to England for a steel man and finally persuaded a small company down in Ohio to try making it. They were doubt-

ful about it, but he guaranteed them against loss. They actually failed at first, but he was not ready to give up. He persuaded them to try again. This time they succeeded.

Vanadium steel would enable him to make a much lighter car and at the same time much stronger. Many other new ideas were to be built into it, such as a magneto, left-hand drive, detachable cylinder head, and so on, but everything would be so simple that anyone could run the car, as well as repair it if necessary. It would be sold at such a low price that even working men could afford to buy one. Ford's job, after the car was once designed, was to build it fast enough to care for the demand.

Meanwhile the runabouts were being sold. Other events were happening that affected Ford in one way or another. The Electric Vehicle Company went into the hands of receivers, and for a time it looked as if Ford's suit over the Selden patent would be dropped. But the Association of Licensed Automobile Manufacturers were not yet ready to declare peace with Henry, and the matter was taken up anew.

The news had leaked out that a new Ford car was coming. Just before summer began, Ford

gave the first glimpse of it to the people of Detroit in a gigantic electric sign on the roof of a downtown opera house. All summer long the plans progressed. New machinery was installed. The managers of the various Ford branches were called in to learn about it. Contracts were let for the new plant to be built at Highland Park.

By that time there were ten branches or sales and service buildings, operated by the company around the country in addition to that in Detroit. Nearly thirteen hundred dealers sold Ford products. The Canadian plant was now making three hundred and fifty cars a year and had one branch at Toronto.

The new car, the Model T, was to be officially announced October 1st, with the opening of the new business year. The wind-up of the old year on September 30th showed that nearly sixty-four hundred cars had been sold. The volume of business was less than in 1907, owing to the advent of a new car. But the profits were near the million dollar mark.

CHAPTER XIV

TO BUILD A SINGLE MODEL

IT MAY seem amusing to you, who have often seen a dilapidated Model T Ford car leaning against the curb, to hear that at one time people actually fought to get one of them. When it first came out, it was a seven-days' wonder. It had features offered by no other car. People scrambled over each other in their haste to place orders. The first week after Henry introduced it more than one thousand had been spoken for.

One change was in the driver's wheel—it was located on the left instead of the right-hand side of the front seat. That was just the opposite of the style in Europe where vehicles passed each other on the right side. Henry felt that the wheel should be changed over to the left, because in America vehicles passed on that side, and a driver could see what he was doing without leaning 'way over as he had to when his seat was on the right.

Secondly, Ford did away with the old system of crawling under a car whenever it was in need of repairs, which was usually two thirds of the time. He made the top of the motor removable, so that it could be unbolted and lifted off, thus enabling one to get at the inside of the cylinders. Usually a man wanting to get at the interior of the motor had to lift it bodily out of the frame of the car or else crawl under it and thrust up from beneath. Henry's innovation was called the "detachable cylinder head." Practically all cars use it to-day.

In the third place he introduced a new method of "casting" cylinders. In the old days each cylinder was manufactured separately, assembled with as many more as were to go into the motor, and all were then welded into one piece. A four-cylinder motor consisted of four separate cylinder castings welded together.

Henry said, "Let's reverse the process. Let's make all the cylinders at one time out of a single engine block. Then they will be even and true, straight in line and much simpler. There will be less parts to repair."

This was called "casting the motor en bloc."

For another thing, he used his new steel alloy,

vanadium. There were many other new features, all of which made the car as popular in its day as the most beautiful of the present-day models is to-day. One feature was the magneto, which up to that time had been regarded as an accessory and was sold as an "extra." Ford put on the Model T a simple magneto that was almost fool-proof.

With all these selling points, he added the important one of light weight coupled with strength.

Soon his opponents were attacking the car from every angle. The idea of casting the cylinders en bloc led to the cry that such a process was expensive. What would an owner do if he happened to crack one cylinder? He would have to buy a whole new engine!

Henry replied: "What of it? The whole Model T engine costs less than a single cylinder of any other car. So, should an owner crack a cylinder, he can buy a whole new engine for less than a single cylinder."

The opposition claimed that the vanadium steel was just a "publicity stunt." Henry was trying to steal some newspaper thunder, they asserted. Everybody had a good laugh, but near the end of October the United States Navy adopted

vanadium steel for use on its battleships. Then all the automobile manufacturers sat up and took notice. Before long they adopted its use also.

About the most severe charge was that the Model T was so light and flimsy that it would fall to pieces on the road. "It couldn't stand long trips or rough going." Henry answered that charge in the spring of 1909 when he sent two Model T cars across the country from New York City to Seattle, Washington, over impassable roads.

The occasion was a transcontinental run for a trophy cup offered by an exposition in Seattle. A number of heavier cars raced against him. Across mountain roads, up grades of 33 per cent., into places where no automobile had ever before penetrated and where the heavier ones broke down, the Model T's blazed the trail. They reached the last big barrier, the Cascade mountain range, before the snows had melted from the summit.

Henry had gone on ahead, and when he saw the difficulty he hired a crew of snow shovelers, took them up the mountain side, and dug through the snow so that the cars could reach the western slope. One of the cars won the race and the trophy.

The hardy endurance of the "flimsy" Model T was the talk of the country.

In less than six months after the model had been announced it was necessary to suspend all orders until midsummer, because the entire output of the factory was spoken for.

The factory was still building a few Model S's and other types. But most of its attention was given to the Model T. One morning Henry told his men that from that time on they should confine all their efforts to the single car, the Model T.

This order fell like a bombshell among the workers. Every other manufacturer of that day had all the way from ten to thirty-two different models. These were needed if a dealer was to give the customer what the customer wanted. Some of his salesmen told Ford that his business wouldn't last six months if he held it down to a single model.

But Henry was guided by his ideal of a sensible, inexpensive car that the average person could afford to buy, then to use. All the "fixin's," the extras, and the finer luxuries were all right for those who could afford them, and quite a few cars could be sold, he knew, to such people. But his

ambition was to make a car for the common people. And in this a simple, modest automobile was all that was needed. He made his decision and he stuck to it.

Strangely enough, the direful predictions did not come true. Instead of dropping away the sales increased to a point almost beyond belief. Although he had only one model for the customers to pick from, they seemed to buy it just as fast as he could build it.

So the Ford Motor Company hummed along to the close of its sixth year. The capital stock had been increased to two million dollars. The number of branches mounted from fourteen to twenty-two. On New Year's Day the plant was moved to the new location at Highland Park. This gave the company twelve acres for the factory instead of two and one half, and provided work for more than two thousand men.

The transfer had been delayed owing to unexpected difficulties with the new brick buildings. Three structures comprised the plant, the main or A building, the office building, and the power house. The first named was the largest building under a roof in all Michigan. During the delay

the plant at Piquette and Beaubien avenues ran overtime. It was impossible to move out the machinery, because that would compel a shut-down. So entirely new machines were bought for Highland Park, and the old plant kept on running right up to the last minute.

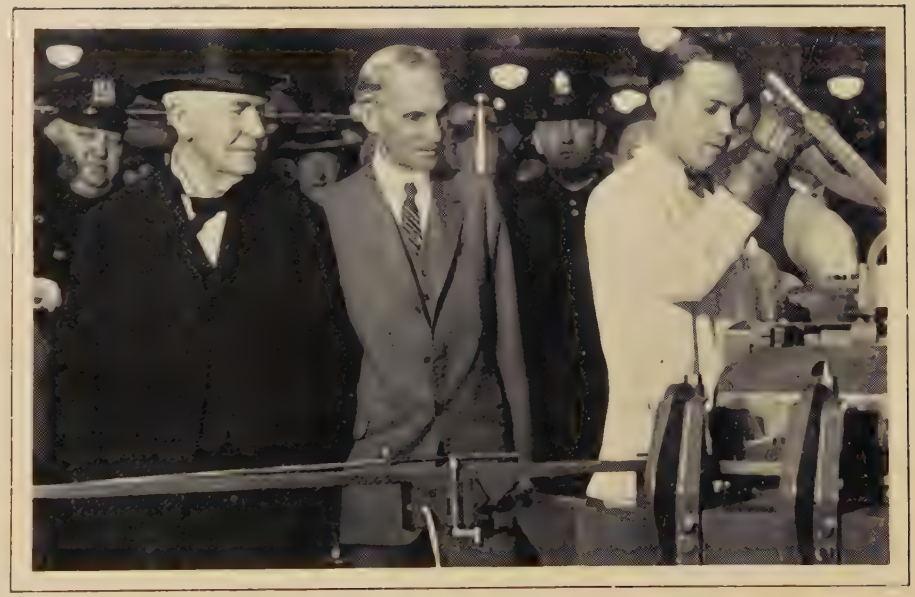
The year 1909 at its close saw more than 250 firms building motor cars. Fully 160,000 cars were in use in this country. In New York State more than 70,000 cars were registered. Tops, windshields, and gas headlamps were in general use.

Ford's business for 1909 was more than $9,000,000, almost twice that of 1908. The profits passed $3,000,000! More than 10,000 cars were sold.

All this was in spite of a terrific blow that Ford received that year—one that threatened to put him out of business. A Federal judge in the East finally decided the suit against him for infringing the Selden patent. Ford was wrong, the Court held, and so were the other "unlicensed" manufacturers.

Great jubilation reigned among the opposition. Several of the independents decided to quit the fight and to join those who were paying royalty.

The original Ford car and the Fifteen Millionth Model T, taken at the Dearborn engineering laboratory.



Thomas A. Edison and Henry Ford watching the operation of one of the Ford welding machines at the New York Show.

Not so with Henry. He declared that "he had not yet begun to fight!"

The association published large newspaper advertisements warning all buyers of the danger of owning cars made by an "unlicensed manufacturer." Again there were hints of trouble and prosecutions.

This stirred the ire of the Ford Company, and a reply was prepared and printed in the New York and Chicago newspapers. The company offered to protect all Ford buyers with a bond against any prosecutions or trouble from the association. Ford said he would spend as high as $12,000,000 to protect them! He would have spent more, but that was all he could get to pledge.

Back came the association: war was to be declared against the "unrecognized automobiles." The public was to be educated against buying them.

Henry replied. The automobile industry, he said, would take its course like any other. The unfit would be weeded out and the strong would survive. No monopoly or restrictions would ever change this natural course of events.

The sympathy of the public was all with

Henry. He was the "under dog," the "fighter," the David who was battling Goliath. "There is a man for you—a man of backbone!" said one newspaper. "Ford the Fighter—Salute!" read one of the headlines.

All this helped to sell Ford cars.

CHAPTER XV

VICTORY

HENRY FORD looked ahead into the future and read what he saw there with almost prophetic eyes. He had a vision of the greatness of the automobile industry that few others possessed at the time. Most of them thought it had already reached its highest development.

"The car of the future," he said early in 1910, "must be a car for the people. A car that any man can own who can afford a horse and carriage. And, mark my words, that car is coming sooner than most people expect."[1]

In those days, when manufacturers were making two million horse-drawn vehicles each year, all the automobiles built in the entire country did not exceed seventy-five thousand. To say that from such a small beginning would come a growth which in time would supplant the other vehicle must have sounded absurd to many hard-headed business men.

[1]Detroit *Saturday Night,* February, 1910.

Few had Henry's vision of fast production, or, as it has since been called, "mass production." When his company turned out 100 cars in a single day in 1908 the newspapers called it a world's record. It was four times more than any other builder was making at that time. People marveled at it, but when Henry in 1909 said that he looked forward to making 1,000 a day, even his own associates got uneasy.

Some of the stockholders said in private that he must be joking, because he would not be so foolish as to attempt such a thing. If he ever did they would go into court and get an order stopping him!

There were good reasons for their doubts. The Piquette and Beaubien avenues plant was only large enough to turn out 100 cars a day. A plant ten times as large would be needed, they believed, to make 1,000 possible. And instead of 2,000 men, 20,000 workers must be employed. Such figures were so large that they frightened even the stockholders.[1]

Folks didn't know, of course, that Henry planned to assemble cars by a new method. In-

[1]Although these figures seemed large at that time, in less than twenty years Ford was employing 200,000 men instead of 20,000 and was making 10,000 cars a day instead of 1,000.

stead of having the workers go around the assembly room and put the cars together he proposed to have the cars brought to the men. Instead of having one or two men assemble an entire car by themselves, he would have each man add a single item to the cars as they passed. When each car reached the end of the line it would be complete.

Henry still recalled his early dream of making watches by the thousands. As far back as 1907, soon after he secured control of the company, he had set his theory in motion. He made the assertion that if the parts of the car were rightly made, they could be built into an automobile without needing any changes after they reached the assembly room. In other words, they would be right before they left the scene of their manufacture.

This was a quite radical idea. Under the old system the various parts had to be adjusted in the assembly room until they fitted into place. But it was impossible to take a part out of one car and use it on another without making it fit first. Henry's idea was to build each part so that it could be used on any of the cars without special fitting. This idea, that of "interchangeability" of

parts, was not new but it had not been applied to automobiles before.

His plan was described in one of the trade papers in 1909 as follows:

> The utmost care was taken to have the parts of the car absolutely machined to size. No supplementary fitting was possible in the scheme. Every part must go into place without causing a moment's delay in the assembly room.
>
> The manufacturing world stood aghast. Only a very few believed Ford would progress far with so radical a departure. But he did. . . . And the principles laid down in Henry Ford's general scheme are substantially those that prevail in the industry to-day.[1]

Another vision of his that came true was the outcome of his long hard fight over the Selden patent. This ended early in 1911. After seven years of legal battle and after losing the first round in the lower court in September, 1909, Ford won a complete victory in the Court of Appeals. The Court declared that Ford had not infringed the patent.

That meant that none of the other manufacturers had anything to fear from the patent, either.

[1] From *Cycle and Automobile Trade Journal.*

The royalties stopped at once, and the automobile industry was free. Ford's opponents, members of the association, were the first to hail him for the fight he had made. At a banquet in New York City which was attended by both sides, he was declared by them to be "the greatest man in the automobile world."

After that victory Ford came back to Detroit and went on building Model T cars. During the previous year he had increased his production to more than 18,000; during 1911 he reached nearly 35,000. Each year the number was being doubled. His target for 1912 was 75,000.

All this meant that it was necessary each year to provide more floor space for the factory at Highland Park. By 1911 it had spread out over thirty-two acres and more than 4,000 men were on the pay roll.

The sales that year came to $25,000,000 almost; and the profits were nearly seven millions. That was only eight years after the company had been started. It had twenty-eight branches, and a plant was being built in England.

During the next year the growth was even more startling. The plant increased to sixty acres

in size. The number of workers again practically doubled. The company was making, it was estimated, one third of all the automobiles built in this country and Canada!

As for sales, they well nigh doubled again, reaching the enormous sum of $42,000,000.

Henry's influence was felt in every corner of his husky organization. His ideas were no longer looked upon as foolish. He insisted that his plants be clean, a lesson he had learned in his boyhood from his mother. In the factory, dirt and refuse were unknown.

Another thing he abhorred was waste. Wherever possible, he sought new machines which would cut down time and increase efficiency. People said this would throw men out of work, but he answered that he was hiring more men all the time.

When he found that the men had to stoop over at their work of assembling the cars he had the assembly line raised up so that it would not be necessary.

Many other improvements in manfacturing were made. He built a huge power house out in front of the plant, where people could see the engines at work. This was rather novel; usually

the power house was placed back in the rear somewhere out of sight.

In 1913 the demand for the car was so great that even after doubling the plant again it would not be possible to make enough. So Ford hit upon the plan of establishing small plants in different cities about the country. He arranged to ship parts in carload lots. The cars would then be assembled right in the very territory where they would be sold and used.

This meant a big saving in freight, since only a limited number of automobiles could be stowed away in one freight car at a time, whereas large quantities of parts could be crated in and shipped, a carload at a time.

Thus the production was more than doubled in 1913, attaining the total of 168,304 cars. The sales also more than doubled, aggregating $89,000,000 for the year. The profit was more than $27,000,000. The number of employees had passed 14,000.

This was all when the company was still only ten years old.

As the number of cars went up each year the price had gone down. Whenever Henry found he could cut something from the cost of manufacture

he passed it on to the buyer. The Model T had been priced at $850 when it was first put on the market. By 1913 it was down to $550.

But still the profits continued to pile up. At the end of the year Henry decided upon a step that once more was to make people wonder if he had not blundered at last and committed a mistake that would cause his ruin.

That was when he adopted the eight-hour day and the five-dollar minimum wage scale.

CHAPTER XVI

THE PEACE SHIP

ON NEW YEAR'S morning, 1914, Ford called together his executives in the Highland Park offices. He wanted to find out what they thought about increasing the wages of the men, while at the same time reducing the hours of labor.

Nine hours comprised the usual work day of that period. The average day's pay was about $2.34 in the Ford plant. Ford worked two shifts, each of nine hours. Altogether, approximately fourteen thousand men were on the pay roll.

From his office window on the second floor, Ford could look down at the doorway, just outside the employment department where long lines of men waited and shivered in the cold January weather, seeking jobs. The sight made him determine to do all he could to relieve conditions.

"If we let the men work eight hours instead of nine," he said, "we can have three shifts in-

stead of two. That will mean jobs for at least four thousand more men."

His entire plan was ready before the New Year's meeting. He even had decided what the men were to be paid. But he wanted to get the opinions of his helpers.

So he asked them how much the daily wages should be increased. Someone suggested a boost of twenty-five cents. That was jotted down on a blackboard. Another rather timorously added twenty-five cents more, making fifty cents in all. Seven thousand dollars a day! More than two millions for the year!

But Ford was not satisfied. He urged them to boost it higher. Finally an increase of a dollar a day was reached. That meant four millions for the year By that time they were all ready to stop. But still he urged them to raise the pay again and again. At last it crept up to another dollar, a total increase per day of two dollars. Eight millions a year!

Some of the executives wondered what was wrong with their chief. They did not dare to think of such a tremendous increase. But still Ford was not satisfied. He did not stop until the raise amounted to two dollars and fifty cents a

day. Even the poorest employé was to receive five dollars every day. It would cost the company nearly eleven million dollars the first year.

It seemed unwise, if not dangerous, to take such a big sum out of the year's profits. Only one or two of the executives felt that Ford knew what he was doing. Next, he proposed reducing the day from nine to eight hours, although the men were still to get five dollars a day. As his associates realized the significance of this change, they grew more alarmed than ever. At least four thousand new men would have to be hired, possibly more. If each was to be paid five dollars a day, it would cost another six millions at least.

While they were debating about this, Henry proposed that they take ten million dollars more and divide it among the employés as a bonus.

Such a combination of radical steps was too much even for his associates. They shook their heads and waited anxiously for the results. The public announcement rocked America. People could scarcely believe it. It was hailed as the sign of "a new era of industrial freedom."

As the announcement appeared, a rush started toward the Ford gates. It seemed that everyone wanted to get on the Ford pay roll. But Henry

was prepared for this. He refused to employ anyone who already had a job. Preference was given to married men out of work.

All over the country people talked about the five-dollar minimum. The eight-hour day was not new, but it had never before received such an impetus. Before long it was adopted generally in the industrial world.

Ford's belief that the men would do just as much work, if they were well paid, in eight hours as they had in nine was soon justified. The number of cars turned out by his men climbed day by day. It passed the thousand-a-day mark that he had predicted only six years earlier, when the world's record was 100 a day.

By the time summer was at hand he startled the country with another offer that created still more excitement. He agreed to pay a bonus back to each purchaser if the company sold 300,000 cars during the twelve months ending July 31, 1916. It would amount to about fifty dollars a person.

During the past year the company had sold approximately two hundred and twenty thousand Model T's. In order to make the bonus possible, there would have to be a gain of about

eighty thousand cars. To help it along, he dropped the price again, so that the touring car could be bought for $440.

Just then the World War broke out. England, France, Russia, Belgium, Austria, Germany, the Balkan states, Japan, and many other countries joined in. Most of the foreign markets were closed to Ford except for military uses.

Many Ford cars saw service as ambulances and transports. They played an important part on every front. Since the United States was not yet in the war American business pushed ahead at top speed.

At the outset of 1915 Ford business promised to shatter all past records. The number of his workers had multiplied to 21,000. The business of the company exceeded one hundred and fifty million dollars. And the company was only twelve years old!

Summer marked the end of the deal between Ford and the Dodge brothers to build his motors. They were anxious to build a car of their own, and announced that the long business connection was to be severed with the expiration of the contract.

The number of Model T's sold during the

twelve months exceeded the mark set, 300,000, by July 31st. True to his promise Ford began refunding fifty dollars to every person who had bought one of his cars during the year. Checks were mailed to almost every corner of the United States.

Meanwhile Henry had been looking ahead once more into the future. Although his factories were now occupying more than a hundred and fifty acres of floor space, he saw that an even greater plant would be needed if room was to be provided in which to build all the cars that the people of the future would demand. Already he was making more than two thousand cars a day.

West of Detroit not far from his boyhood home at Dearborn was a tract of swampy land, through which the River Rouge flowed. Quietly he set to work to buy up this land, seeking at least one thousand acres on which to build.

Ford had established his home once more near Dearborn and had added many small farms to the original forty acres. In his spare time he still experimented with a "farm locomotive" which would relieve the work of the farmer. During 1915 he reached the point where he was ready

to undertake manufacturing of a light-weight tractor. Ground was broken for a plant at Dearborn.

While all this was under way Henry became engaged in another enterprise that was actuated by his desire to serve the common people. The world was ablaze with war, more nations had been drawn into it, and the end seemed farther away than ever. Peace workers from neutral countries approached him, after failing to enlist the aid of the government, and urged him to take the lead in trying to bring about the end of the conflict.

With characteristic sincerity Ford plunged into the fight, determined to do his utmost to bring about peace. He tried personally to get President Wilson to appoint a neutral commission for mediation. Like the others, he failed. Then he announced that he himself would finance a neutral commission which was to make a trip to Europe. The boys were to be got "out of the trenches by Christmas."

In this undertaking Ford sought to benefit mankind as a whole. The United States had not yet entered the war, and Ford was one of the few if not the only large American manufacturers who

had refused to let his plant be used for war work.

His peace ship, the *Oscar II,* sailed from New York City December 4th with 165 persons on board. Of that crowd, about 25 were college students, 55 were reporters, photographers, or special writers. The balance were peace workers or "delegates."

A few thinking people regarded his project seriously. Cardinal Gibbons described it as the "world's finest and best gift for Christmas." A number of important persons joined in it, including Judge Ben Lindsey of Denver. But most of the public, including the American press, ridiculed it as a visionary dream that never could accomplish its aim.

In a statement issued by Ford just before the ship sailed, he said:

"Little harm can come of the venture and great good may result from it. It will keep alive the thought that peace is possible as well as desirable, and as long as that is done, the hope of peace exists."

The ship touched at Christiania, Norway, and other north European ports. But even before it arrived Ford realized that his object could not be attained. Disappointed, he returned to Amer-

ica. The warring nations were not yet ready to listen to peace overtures.

While the expedition was a failure in so far as its mission was concerned, it made the name of Ford dearer than ever before to the common people. They realized his deep sympathy and interest in their welfare, in the European countries where the war was raging, as well as at home. From that day forward, even more than previously, their trust in him grew, not only in America but all over the wide world.

Late in 1915 James Couzens resigned his active connection with the company. The one-time bookkeeper had grown up with the organization until as its secretary he had become a multimillionaire. He remained as director until 1919.[1]

During 1916 the company shot ahead at a tremendous rate. Nearly three thousand cars were turned out each day at Highland Park. Fully thirty thousand men were employed. One million Model T cars had been built and sold since 1908.

By midyear the number of cars made since

[1]Subsequently Mr. Couzens became United States Senator from Michigan. He was also Mayor of the City of Detroit.

the preceding midsummer totaled more than half a million. The year's business was more than two hundred million dollars!

The profits had been nearly sixty millions; and the cash on hand was more than fifty millions.

Henry now felt that he was ready to proceed with his new manufacturing plant. He called in a famous designer to plant blast furnaces and was getting things started when his old associates called a halt. They demanded that the profits should be distributed among themselves as stockholders rather than invested in the new plant.

They believed that Henry was wrong in attempting to build a plant which would be even larger than Highland Park, already one of the greatest in the world. They prevented him through court action from taking the money. Nevertheless, he went ahead with his plans, using his own funds until such time as the matter could be settled.

Later the plant which he built became known as the River Rouge or Fordson plant. It is now one of the industrial marvels of the world. The dispute with the stockholders ended in 1919 when Edsel Ford bought out all the minority stockholders.

CHAPTER XVII

WAR

IN APRIL, 1917, America plunged into the World War. The country was woefully unprepared. Ships, men, and munitions were needed.

One of the first to place their manufacturing resources at the disposal of the government was Henry Ford. Up to that time, so long as the United States was not involved, he had consistently refused to accept any orders for war goods.

But he had not been asleep. His experiences with the Peace Ship convinced him that if peace was to be obtained it would have to be won in a sterner way—by the might of the sword. So he began to get ready. He ordered his own yacht overhauled. He rushed the work of clearing and draining the River Rouge site. He speeded up work on the new Henry Ford Hospital that was then in process of construction.

And when the government asked him how long it would take him to swing his plants into war production he asked for twenty-four hours. That was all!

A food crisis threatened England. The submarine had levied a heavy toll on shipping and supplies were low. All available horses were needed for the army. The British cabinet asked Ford to come to its aid.

Tractors for farm work such as Henry had been developing since his boyhood would meet the emergency. Ford offered to furnish five thousand at a lower cost than the English factories could make them for, and to start shipment within two months.

The offer was accepted. An extension was built overnight on the Dearborn plant, which was getting ready to make tractors for American use. By December, 1917, the first tractors were in London.

Liberty motors were needed for airplanes. Ford engineers applied to the job their skill in devising new methods for rapid production. They were able to lower the cost of making each motor by a thousand dollars under the government's estimate.

All of the cylinder forgings for all the Liberty motors made during the war in this country were built by Ford, fully four hundred thousand various parts. The contract price for each cylinder was twenty dollars. Ford was able to cut the cost down to twelve, thus saving Uncle Sam eight dollars on each.

Many other things were made in the Ford plants. Ten thousand gun caissons were turned out, on which Ford saved the government $500 apiece. He made nearly three million doughboy helmets, and cut the cost on each from thirty to seven cents.

Nor was that all. Cars, trucks, tanks, and listening devices were made. And Eagle boats.

Because America had entered the war unprepared there was grave need of light, speedy boats with which to outfight and outmaneuver the submarines. The Eagle type of boat was selected for this purpose by the government.

Someone had to be found who could build them fast and in quantities. Ford was the man. He had the facilities and was willing to undertake the task, although he had never built a ship.

Ten miles from water a model boat was constructed within one of the buildings in the High-

land Park plant. Then Ford had his men tear it apart to find out the best way to assemble it.

Meanwhile he put another crew of men at work on the River Rouge property. Two immense buildings went up like magic. In less than five months they had been completed, the machinery was installed, and the first Eagle boat was ready for launching!

During the summer of 1918 Ford's men performed many prodigious feats. In four months, forty-three of these fast submarine chasers were hatched. In a single month, eighteen! A world's record for fast shipbuilding was established.

The construction was still under way at a furious rate when the Armistice was signed. Later, the Ship Building became B Building in the River Rouge or Fordson plant and is to-day an important unit in that enterprise.

Henry Ford returned to the government his personal profits received from all the war work which his company had done during the war. The service flag of his company was the largest of any in America. It held seven thousand stars.

About the time of the Armistice, Ford, in response to a request from President Wilson, consented to run for the office of United States

Senator from Michigan. The office had nothing to offer him except an opportunity of service. This he reluctantly agreed to undertake at the insistence of the chief executive.

His name appeared on the ballots of both Republican and Democratic parties. On the former he received 71,800 votes; on the Democratic he was given 30,791. The election was won by Lieutenant Commander Truman H. Newberry, a Republican. Subsequently Senator Newberry became the subject of an investigation by the United States Senate.

Two years later the Republicans of Michigan in their state primary directed the delegates to the national Republican convention to cast their votes for Ford for President. Ford, however, in a signed statement declined to run for that high office. He was busy and contented with his own job, that of managing the Ford Motor Company.

About that same time Henry decided to call a halt on some of the unfair things that were being said about him in some of the newspapers. Because his motives were misunderstood many editors did not hesitate to condemn him unmercifully. Ford did not mind when they called him a "crank" or even a "fool," but he did object

when they went so far as to brand him as an "anarchist."

One of the leading newspapers of the country, the Chicago *Tribune,* had described him in that manner. Ford determined to prove that the epithet was undeserved.

Suit was brought against the newspaper and after a long legal battle in Mount Clemens, near Detroit, Ford was awarded the verdict, clearing him of the charge. He had not cared about financial recompense, and the jury gave him the nominal damages of six cents.

Ford himself was called as a witness and compelled to answer a wide range of questions, such as "Who was Benedict Arnold?" He was interrogated as to whether he could read or write the English language! Despite this ordeal he felt that he had won a moral victory and had been cleared for all time of the charge that he was opposed to government.

The charge was unjust. Since that trial many of his ideas have become better understood, and the same newspapers which attacked him in the old days have since praised him even more strongly than they condemned him at that time.

One reason it was unjust was that in the Ford organization among the foreign workers Ford maintained a school in which the fundamental principles of American government were taught to these aliens. It was true that he opposed war; but that did not mean he did not love America or her institutions.

His record during the World War, when he was given a 100-per-cent. citation by the government, was proof in itself of his whole-hearted support of the country when it was engaged in war.

Another school which was started by Ford was for young boys who did not have the advantages of schooling or of learning a trade. It became known as the Henry Ford Trade School. Each boy was given two weeks of practical shop experience, followed by two weeks of classroom instruction. During all this period he was paid for his time.

Graduates from this school stepped into responsible positions in the organization. The latter was so large that it was impossible to find enough trained tool makers and experienced machinists, and the schoolboys, on completing their

course, helped to fill this need. They were given a wide variety of trades from which to choose their life work.

They received vacations with pay, increases in their wage envelopes at stated intervals, and were encouraged to save. Ford felt that his investment in the boys was returned to him many fold in their service. A building was set aside for their use near the Highland Park plant. Since that time the school has always had a waiting list of thousands of boys seeking a chance to enter. Many thousands have received their training there.

CHAPTER XVIII

BRINGING THE DOLLAR BACK

FORD'S desire to invest the surplus profits of his company in a new industrial plant on the Rouge River had been opposed by his old-time associates, although a substantial dividend had been given them each year, mounting into the millions.

When he stubbornly insisted on going ahead, they blocked him by going into court, where they secured a ruling that compelled him to turn over more of the profits to them. After that decision was handed down, Henry felt that he had only one thing left to do—buy out all of them.

This was arranged through his son, Edsel. The latter, now a young man of twenty-six years, had already received a course of training in the Ford shops and taken over some of the work of administration as secretary of the company. Now he was to become its president.

All this stock had sold sixteen years previously

at $100 a share. Now, in order to acquire it, Henry and Edsel had to pay very high prices. Miss Couzens, sister to James, had one share. It cost them $260,000 to obtain it. James himself sold his interests for about $30,000,000. The Dodges sold their $10,000 interest for $25,000,000. The banker Anderson and the lawyer Rackham each sold for $12,500,000. The Gray interests were bought for more than $25,000,000.

In order to help provide the money for such a tremendous cash outlay, the Fords borrowed $70,000,000.

After all the stock in the company was under his control Ford reincorporated the company for $100,000,000. Then he proceeded to dig in at the River Rouge and go ahead with his plans for development.

What he had in mind was a plant in which the raw materials would go in on one side, and the finished cars, trucks, and tractors would leave at the other. All the processes of manufacturing would be under his control. He would even make his own steel.

Likewise, he would control the means of transportation, both railroads and ships.

Finally, he would own his own supplies of raw

material—coal, timber, limestone, ore, and all other elements needed.

Waste would be eliminated. He would cut down the time that was being lost. He would reduce the expense of manufacture. All these savings would be passed on to the car purchaser in the form of reduced prices.

These things were in his mind when he tackled the swamp tract of ground back in 1915.

As his plans took shape, he constructed foundations along the banks of the River Rouge for great storage bins, capable of holding two million tons. These were to hold the ore, coal, and limestone that would be unloaded from ships inside the plant. Some day the ships would steam up the Rouge from the Detroit River and the Great Lakes. Meanwhile, the cargoes were to be transshipped to smaller craft and hauled up the river until such time as its channel could be deepened and widened.

Near the bins were the two blast furnaces in process of construction. Not far distant from them a foundry was under way, to be the largest in the world.

The scene baffled description. Some writers compared it to the Panama Canal. The noise was

almost continuous, with excavators, cranes, derricks, large and small locomotives with trains of cars, steam shovels, riveters, and thousands of men at work. Back of the foundry, work was begun on a power house that was to be another world marvel.

One step in reducing waste was the building of a battery of coke ovens. Here certain by-products were to be extracted from the coal, and coke provided for use as fuel. Coal which cost the company $5 a ton delivered at the plant was to be made to yield materials worth $12 to $13.50.

The effects of the World War still lingered in the minds and habits of the people months after the signing of the Armistice. The whole nation had been keyed to such a high pitch and had lived at that pitch so long that no one dared suggest slowing up, or bringing conditions back to a pre-war basis.

Labor was scarce. It had to have high wages because necessities of life, such as food and clothing, cost twice as much as before the war. Rents were exorbitant. Manufacturers claimed they had to charge double prices for their goods because their workmen demanded such high wages.

Henry realized that this situation could not

continue. Sooner or later a crash would come, unless steps could be taken before long to readjust our scale of living. Already a few business houses had failed here and there—an ominous warning.

Ford began a campaign of "bringing the dollar back to par" by opening commissary stores at the Ford plants. At these, prices of necessities were considerably less than were being asked elsewhere.

"The war is over," said Ford, "and it is time that war prices were over. For the best interests of all, it is time that practical effort was made to bring the business of the country, and the life of the country, back to normal."

He practised what he preached. He made a drastic slash in the price of the Model T car, and at the same time announced that there would be no cut in the wages of his men. In fact, Ford had inaugurated on January 1, 1919, a new minimum wage scale of six dollars a day instead of five dollars.

Ford did not have to cut the price of the Model T at that time, as he had 146,065 orders on hand. The reduction cost him quite a sum of money. Many newspapers praised him for it, saying that

he was pointing the way for other manufacturers. The public also voiced its admiration. But prices still remained up. It was still impossible for him to buy the materials for use in his cars at reasonable prices.

Notwithstanding this, Ford did everything he could to keep business progressing. He realized that if everyone stopped buying it would affect the sale of his cars sooner or later. And so long as men could be kept working, so long as they had money to spend, business could go on.

Even after the sale of his cars began to drop away he kept his men at work. He continued his expansion plans as well. To perfect his control of coal, he purchased large fields holding millions of tons in Kentucky and West Virginia. He arranged to control the transportation of this to his new plant by buying the Detroit, Toledo, and Ironton Railroad, which ran from the Ohio River north to the River Rouge.

To control the supply of timber he bought great areas of forest in northern Michigan extending over great counties. He bought logging camps and began the construction of a huge timber and body manufacturing project at the city of Iron Mountain.

To control the supply of ore he took over a deserted mine in northern Michigan near Michigamme and began clearing it out in order to resume mining operations. The mine had been abandoned for ten years.

Work went on without interruption at the River Rouge plant. Just before summer the first of the two giant blast furnaces was completed and lighted. It was christened the Henry Ford II, after a son of Edsel who was named for his grandfather.

A long snakelike conveyor for carrying parts back and forth was constructed to take the place of interplant conveyances, hand trucks, small locomotives, and so on. It served the new foundry and was more than a mile long.

During the same summer, the Henry Ford Hospital resumed the care of patients. It had been completed by Henry and Mrs. Ford at a cost of five million dollars. At the opening of the World War, it had been turned over to the Army authorities, although not yet completed. It was used during the ensuing years for military purposes, and on January 1, 1920, was restored to the Fords. Then the remodeling had been started.

At the time it was launched, the hospital was known as the "Detroit General Hospital." Many prominent Detroiters contributed heavily towards its building, among them Henry Ford. Several serious disputes arose among them, and for a time it seemed that Detroit would lose the hospital. Ford then came forward and agreed to shoulder the entire financial burden, refunding the money already contributed by the others.

The hospital is now recognized as one of the leading institutions of its kind in America. It occupies twenty acres of ground and serves more than one hundred thousand patients a year.

As the fall of 1920 opened Ford made another cut in the price of his car. He put the price down considerably below the cost of manufacture. He also cut down the value of his materials on hand —in other words, his inventory—by $17,000,000. This meant that he was listing goods for which he had paid $105,000,000 as worth $88,000,000—a voluntary loss. He urged other manufacturers to do the same.

But still prices remained up. The other manufacturers thought he was crazy. Some of them said so.

The Federal Reserve Board, which has charge

of banking credits, got into action about that same time. They had been thinking along much the same lines and feared much the same thing. Already a "buyers' strike" had been launched by the people in some sections to force down prices. In order to compel a deflation of credit and restore business to a normal basis, the Federal Reserve Board reduced its credits.

The remedy was painful, though effective. Although many business firms crashed to the ground, many more were warned in time to save themselves.

Ford, looking ahead, could see that the bump was coming. When it arrived, he wanted his stocks on hand to be as liquid as possible, in the shape of automobiles rather than bins full of parts. He kept the plants at work making cars until all the stocks were used up.

That done, Ford closed down the Highland Park plant, not to resume until a readjustment in prices had been made. He thought that two weeks would be sufficient. As it turned out, it took six.

CHAPTER XIX

THE CRISIS

CAME the storm. Ford had twenty million dollars in cash in the bank as 1921 opened. All his stock of materials had been made up into automobile parts, and the parts had been assembled into cars. Before the middle of April came, he had heavy obligations to meet.

Of the money borrowed to buy up the company stock in 1919 thirty-three millions still was left to pay. Eighteen millions was due Uncle Sam as the final installment on the 1920 income tax. Those two items alone totaled more than fifty millions.

At the close of the two weeks' shutdown, Ford decided not to reopen the Highland Park plant for the present. Business was at a standstill all over the country. The lay-off affected thousands of families in Detroit, and Ford, in order to relieve their suffering, took seven millions and paid it to them in the guise of a bonus.

That left him with thirteen millions with which to meet his obligations. Rumors began to float around. At last, they said, the "wizard" manufacturer had "slipped." The "wonder company" was in financial trouble. Soon, these rumors averred, it would be bankrupt. Ford, they went on, was making a supreme effort with his back to the wall to borrow enough money to keep from going under.

Such rumors, of course, were sheer nonsense. Ford had no intention of seeking any loans, especially when he knew that if he had to pay a stiff price to get money he might lose control of his company. One financier did call on him at his Dearborn home to offer him a loan on terms which would have meant the surrender of control. Ford escorted his visitor to the door and ended the interview.

He had made his own plans for raising the money. He had a large number of finished cars at his disposal. These were sent out to the dealers in monthly allotments until by April 1st he had sold enough to raise nearly twenty-five million dollars.

He went out and collected such bills as were owing to the company for by-products sales and

in foreign countries. He sold some of his Liberty bonds. Thus he obtained fourteen millions more.

Through these simple measures he secured nearly forty million dollars, which with his cash on hand was more than enough to pull him through with flying colors.

But while he was discovering ways to raise funds, he found many other opportunities to prune down the costs of doing business. That was because his organization had grown so large that expenses had been allowed to multiply, in many cases more than was necessary.

He found that the time required for moving raw materials to his plants from the sources of supply could be shortened. During that time he had vast sums of money tied up in those materials. Three weeks had been needed to bring in the materials, manufacture them into cars and ship them to the dealers.

By putting new methods into effect on his railroad he was able to cut down this time to fourteen days, a saving of one third. Thus he lowered his investment in raw materials from eighty-eight millions to sixty millions. That alone saved twenty-eight million dollars.

Many unnecessary jobs were abolished. A whole trainload of desks and other furniture, no longer needed, was hauled out and sold. The office force was cut from 1,074 employés to 528. At least 60 per cent. of the office telephones were removed, as unnecessary.

Through these economies he reduced his daily overhead expense from more than $450,000 to $412,500. It had cost $146 in labor and expense to build a car, not including the raw materials, machinery, and so on. This was reduced to $93. His production was speeded up from 3,000 cars a day to more than 4,000.

By the middle of April the storm clouds had blown over. Ford met all his obligations, and he and his company were on a stronger basis than ever.

The Highland Park plant had resumed operations late in January. The month of May saw the daily production setting new records almost constantly.

Prices were reduced to conform to the lower costs of manufacture. The touring car by August was selling for $355, even less than before the war. By the end of the year, Ford's production

had passed the mark of 1,000,000 cars and trucks for a single twelve-month period. The world marveled at such a showing by a manufacturer. The profits for the year were more than seventy-five millions.

Great as was the production of 1921, it paled into insignificance before that of 1922. In the latter year Ford made more than two million cars and trucks.

The year's business passed the billion dollar mark.

This lofty pinnacle had been reached by Ford in less than twenty years after he started in business with his company.

He was hailed everywhere as the world's leader in industry. People came from many different countries to see the great plant on the River Rouge, which by now had become the world's largest industrial enterprise.

In the years since the Armistice his plans here had slowly rounded into shape. On one side was a glass furnace where he made his own glass, rolling it by a process that everybody said was impossible. On another side was a cement plant which took the slag from the blast furnaces and made it into cement.

By 1923 his dream of having boats come from the Great Lakes directly into the River Rouge and up to his own docks was realized. That made it possible to pass on another saving in the price of his cars.

In still another corner of the plant was a paper mill which took the scraps from lunch boxes and waste-paper baskets and converted them into cardboard for use in crating up Ford parts.

In such fashion he cut down waste wherever he found it. At the Iron Mountain lumber mill he installed a plant to take the scrap and waste lumber and utilize it as charcoal or as chemicals.

By the close of 1923 he had more than 150,000 men on his pay roll.

Still he continued to make his dreams come true. During the next year he built two great motor ships, the *Henry Ford II* and the *Benson Ford,* to transport his own coal, ore, and timber. Other boats were added until a veritable Ford fleet was on the waters. Soon he began shipping his parts by cargo around to the Pacific Coast to South America, and to Europe.

Next came the completion of his ten millionth Model T car. During that spring his plants had succeeded in turning out one million automobiles

in the record time of five months and nine days.

The ten millionth car was the first ever built whose motor number bore eight figures.

In order that the whole country might see the car, Ford sent it on a trip across the continent from New York City to San Francisco, California, via the Lincoln Highway. His old racing driver, Frank Kulick, was at the wheel. Everywhere it was greeted by governors, mayors, parades, and bands. In Hollywood such famous movie stars as Douglas Fairbanks, Mary Pickford, and Bill Hart rode in it.

During 1924, also, the Fords embarked in the experimental development of airplanes. Their first efforts in this field were made as far back as 1908. They rigged up a plane which flew, but it finally ended its career against a fence. Luckily, no one was injured.

Their determination to undertake further experiments in 1924 was caused by the desire to pioneer an all-metal monoplane which would be safe and dependable. They set aside land for an airport, built a factory and a hangar, and constructed experimental planes for the carrying of Ford parts and mail. Later they began the sale of planes commercially.

At the end of 1924 the price of the Model T touring car was down to $290. Ford's pay roll for the year was more than a quarter of a billion dollars. In South Africa, a Ford plant was being constructed; in fact, they were located all over the world.

Ford of Canada completed its 500,000th Model T. It was the largest automobile manufacturing plant in the British Empire.

CHAPTER XX

A BILLION A YEAR

HENRY FORD was sixty years old in 1923. Perhaps it would be more correct to say he was sixty years "young," because his age rested lightly on his shoulders. His hair had turned to silver, but his eyes had the sparkle of youth, and he was just as active as ever. Early in the morning he was hard at work, and frequently he was among the last to leave at night. His energy seemed inexhaustible, and his knowledge of the business was complete. He still directed its major operations just as surely as in the days when only a few thousand cars were made each year and only a few thousand men employed.

He still continued to make his dreams come true. New ideas came, but he never lost sight of his first love, the building of a car for common people.

During 1925 he undertook a big task in the

River Rouge plant.[1] One of his earliest ambitions had been to control the manufacture of steel in all its phases. Now he was able to realize that hope. By doing so he cut down much of the material he had to purchase from the outside. When his great steel mill was finished, it extended more than half a mile long. It was one of the largest in the world. At one end the iron ore entered; at the other, the finished steel was taken out.

The total number of cars built in a single day ascended to more than nine thousand. The time of assembling a motor was reduced to two hours. Ford plants were established in Australia, Japan, and Mexico.

Meanwhile the number of employés had passed the 190,000 mark. As in the past few years, the total business again exceeded one billion dollars for the twelve-month period.

The activities of Mr. Ford were just as widespread as ever. One important event of the year was the purchase of 199 merchant vessels from

[1]During 1925 the name of the plant was changed to the Fordson plant to conform to the name of the city which had sprung up around it and which had been formerly known as Springwells. Late in 1928 Fordson merged with Dearborn and the plant's name was changed back to "Rouge Plant."

the government for scrapping. These ships had been constructed originally for use during the war, but since that time they had been swinging idly at their anchors, useless except as scrap. Ford proposed to dismantle them and reconvert the metal into practical use.

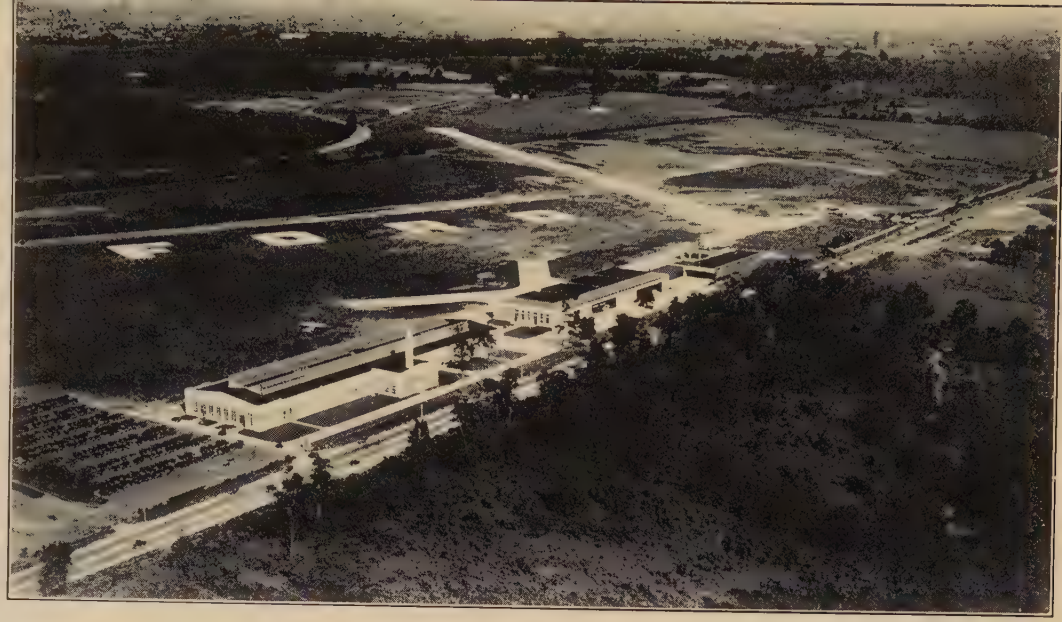
This task was just one of the many that Ford performed, but it was the largest scrapping job in history. The ships had to be towed, either by tug or as scrap, to Fordson all the way from the Atlantic coast. It was the world's largest towing job.

Big or unusual jobs did not frighten Henry. In fact, he seemed to like them.[1]

Running his own company was a big job, yet he felt, as he once said, "the bigger our business gets, the easier it is to run."

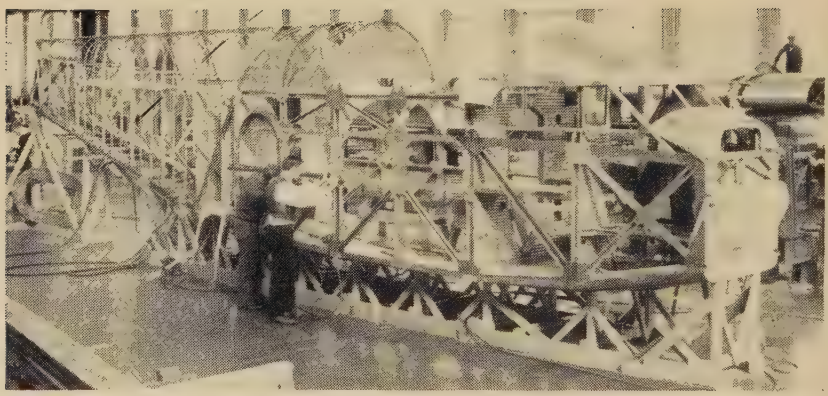
In the South was a huge power project on the Tennessee River. It was known as Muscle Shoals. After the war it lay idle, although capable of tremendous development. Ford offered to place it in useful service, but the politicians were afraid to let him. His offer was allowed to go unaccepted until finally he withdrew it.

[1]The scrapping of these vessels was completed by the year 1928. A few of the ships were reconditioned and placed in marine service. The rest were dismantled.

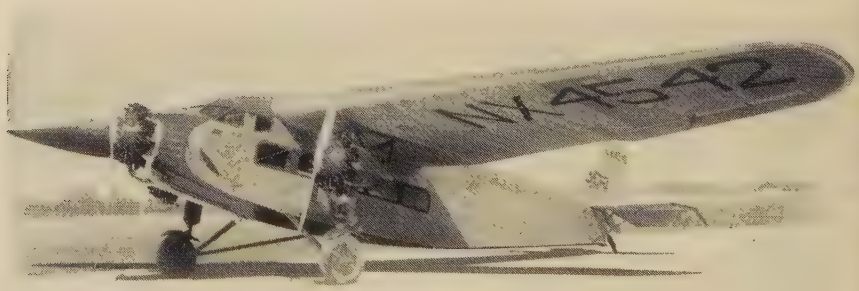


AIRPLANE VIEW OF FORD AIRPORT AT DEARBORN

In center distance can be seen smokestacks of Rouge plant. In center of the far edge of clearing is mooring mast for dirigibles. On right of runway is airport where passengers board planes. The largest building with the single smokestack is the airplane factory, where as many as three tri-motored all-metal planes a week are built. Adjoining on the right is the public hangar where planes of all makes are stored as in a public garage. Here is the "Josephine Ford" which flew over the North Pole; the "Spirit of Detroit" which flew almost around the world, and other famous planes.



Inside the Ford airplane factory, showing how the all-metal monoplane is assembled.



Ford monoplane taken by Commander Richard E. Byrd on his Antarctic expedition.

Another example of his willingness to undertake seemingly gigantic tasks even after his sixtieth birthday was given in 1927, when he leased more than four million acres of jungle in Brazil and set out to clear them and transform this wide area into a huge rubber-development project.

None of these tasks, however, was comparable to that which he undertook in 1927 in his own factories. For nineteen years all his plants had been attuned to the manufacture of the Model T. His investment in machinery especially designed for that work amounted to many millions. Now he proceeded to make over his plants completely for the production of an entirely new car.

It was the greatest industrial task that had ever been attempted in history. Ford had been convinced for some time that the day of the Model T was passing. He experimented with new designs, and meanwhile arranged to terminate the career of his other car when the 15,000,000 mark was reached. That happened on May 26, 1927.

As the car emerged from the assembly line its number was stamped on the motor by eight men who had been with Ford since the early days, Wandersee, Degener, Kulick, Rockelman, Mar-

tin, and Sorenson were among them, as were C. B. Hartner and Charles Meida, other old employés.

That marked the end of production of the Model T. It is hard to realize what such a statement signifies. The wages Ford paid to labor during the time of its building had been nearly two billion dollars. The materials purchased by him had amounted almost to five billions.

Thousands of dealers and their employés had made many more billions in selling and servicing it.

Sixty million tires had been needed. The gasoline and oil bill passed beyond all human comprehension.

This stupendous business had resulted from the early faith and determination of a man who years before had the courage to be true to his convictions and had faith in his destiny.

The task of rebuilding the equipment necessary for a new car was indeed colossal. It cost fully $100,000,000. More than 50 per cent. of all the company's machine tools had to be rebuilt. Incidentally, many brand-new machines were also built, for Ford's new car, like the old Model T, embraced new features in manufacturing.

From the moment he announced the coming of the new car late in May, until he showed it for the first time December 2d, the whole world seemed to take an interest in what he was doing. Amusing efforts were made to discover the character of the car. Spies with telescopes watched every road around Dearborn. Frequent newspaper stories describing it were published, telling what it would look like and what it would do.

When it was finally unveiled it surpassed the conjectures of almost everybody. It was entirely different in every feature from the old Model T. In looks it had changed completely, being dressed in bright colors instead of black, and offering many refinements. It was much speedier. It had four wheel brakes, standard gear shift, and shatterproof windshield, as well as shock absorbers.

All of these improvements had been directed by Ford personally. He supervised the testing of the new car, the brakes, the motor, the radiator. He directed the changing of many features which did not satisfy him. Early and late he worked with his engineers, production men, and test drivers. The new car represented throughout his ideas.

He named the new car after the first car he had built back in 1903, the Model A.

Its introduction was the signal for editorials and news stories throughout the civilized world. Leading newspapers published cartoons to mark the passing of the Model T. "Lizzie," they said, had departed. The "flivver" was no more.

The announcement of prices of the new car, practically the same as for the Model T, was set forth on many first pages as a big news item. Weekly and monthly magazines discussed Ford and his plans. Not a few paid tribute to the old car and its achievements. Faraway Japan, India, Australia, and South Africa echoed the news.

Much of this was due to Henry Ford himself. His personality and accomplishments lifted him above the field of ordinary commercialism. He was in truth a world figure. What he said or did was "news."

Yet, only twenty-five years earlier he had been an unknown engineer in Detroit who had quit his job rather than surrender his ideal of a motor car for the common people.

CHAPTER XXI

A TRIP THROUGH THE RIVER ROUGE PLANT

FROM the time Henry Ford built by hand his first automobile down to the present day when thousands are assembled every twenty-four hours, the business of manufacturing has undergone important changes. The day of the single factory building wherein every operation was performed has passed. To-day we have great factories devoted to separate operations, each a unit in a much greater layout. In other words, we have "mass production."

Ford has never made a secret of any of the manufacturing processes developed by him and his organization. Whenever he has discovered a new, speedier way in which to build automobiles, it has been free to the world. Other manufacturers are at liberty to use and profit by those improvements; their presence is welcomed by him.

Perhaps you would like to make a personally conducted tour of the gigantic River Rouge plant. It has been called the "greatest industrial enterprise since the Pyramids." It will be interesting for you to follow the raw materials from the moment they are unloaded out of Ford ships until they are converted into parts and the parts assembled into automobiles. Many of the methods and processes which you will see have drawn the admiration of mechanical geniuses from all parts of the world. Of course, it will be impossible to see everything, for that would require weeks.

Let us select a single part, like the motor, and follow it from the ore bins through the plant until it reaches the assembly line and becomes the engine of an automobile. We will start at the blast furnaces, where the ore goes first after it is lifted out of the bins along the river. We climb up a short stairway that admits us to the furnace floor and walk around the tall, cylindrically shaped furnace, inside which the ore is being reduced. As terrific heat is applied to the ore the impurities and acids are being drawn off, uniting with limestone to form "slag." This will be pumped to a near-by building and converted into cement by what is known as the "wet process," first used

successfully by Ford. Formerly this slag was hauled away for use in road building.

The blast furnaces do more than merely reduce the ore, although that is their primary object. During the reduction process great quantities of gas are produced, and this is piped to the power house where it serves as an important fuel. Some of it is used in heating the "stoves" which form a part of the furnace units. Even the dust from the furnaces is used. When this saving was first attempted, enough had accumulated to furnish iron for more than half a million automobile engines. Now fifty tons of iron are obtained in this manner every day.

Meanwhile the white-hot iron is being produced. Sixteen hours are required for the reduction of the ore, and while we are waiting we will have time to look at another unit. Each two tons of iron ore used in the blast furnace charge require one ton of coke. Hence the supply of coke is an important item. It is produced in batteries of ovens which stand on the southeast corner of the plant. The operation more than pays for itself in the by-products which are derived from the soft coal when the coke is made.

One of the most important of these is gas. Not

quite one half the amount of gas produced is used to heat the ovens. The remainder is sold to a Detroit gas company or used in the plants. There are several other derivatives, such as ammonium sulphate, used as a fertilizer. Then there is benzol, sold at gasoline stations in and near Detroit. At one time it was estimated that the coal which cost the company about five dollars a ton when brought from the Ford mines to the plant yielded coke and by-products worth more than twelve dollars.

We are now ready for the foundry, which as we have said before is the largest in the world. It is near the blast furnaces and combines both foundry and machine-shop operations under a single roof. The molten metal arrives still hot in the ladles in which it was poured at the furnaces, and from the moment it flows out of the ladles its continuous progress does not stop until it leaves the building, a machined casting.

Instead of moving the molten metal from mold to mold, they are brought to it on an endless chain conveyor. After the metal is poured it is carried on the conveyor, cooling meanwhile, through various stations, and finally the molded iron block, still hot, is placed in a tumbling barrel,

where it is revolved to smooth the surfaces. It is then ready for the machining operations which will help to transform it into a motor.

Less than one hour is required for the block to go through these operations. At one machine, for example, forty-eight holes are bored in the block at one time from four different angles. Openings must be drilled for the pistons and the valves to travel up and down. By the time it reaches the conveyor which will carry it on an overhead bridge across the street to the Motors Building it is ready for the motor assembly line.

In the new building, another tremendous structure, we are immediately impressed by the bustle and hum of machinery. Here the iron block is to meet the many different parts which will give it life. Each of these has been, in turn, made separately, and all finally come to the motor at just the right stage in the assembly process. Each must be made neither too large nor too small, because any one of them must fit into any one of the blocks.

Here we see conveyors carrying endless lines of crankshafts. We see men fitting pistons to connecting rods and then pistons to the cylindrical holes in the motor blocks. We see inspectors meas-

uring each part to make sure that it will come within the prescribed limits. We see Ford-developed machines which perform as many as eight different kinds of operations, all directed by a single man. Finally we see the completely assembled motor leave the line and go to a testing stand, all in less than one hundred minutes from the time it reached the building.

Had we time to go through the different buildings we would find each of these parts being made. We would find, in the largest forge shop in the world, steam hammers weighing 150,000 pounds, dropping on heated steel to shape crankshafts and other forgings. We would see ribbons of steel transformed into roller bearings. But we must follow the motor now as it leaves the building and goes to the huge general assembly building where it is to become a part of the car.

As we enter this last-named structure we recognize it as the edifice built so quickly by Ford at the time the United States entered the World War. It was used then for the manufacture of Eagle boats. It houses many manufacturing operations now, but we are chiefly interested in the north side, where the final assembly line stretches out toward the far doors.

The rear end of the car, looking like a gaunt triangle of iron, is swung into place on the conveyor. The front end joins it, and the motor, coming in from the side on a tributary conveyor, is set in place even as the chassis moves slowly along the line. Each man has a specific job to perform. The wheels, the fenders, running boards, steering column, the battery, and the other parts are all fitted. So is the body itself. At last the car, nearly complete, approaches the end of the conveyor. A man climbs into the seat and tests different parts of the mechanism, the horn, the head lights, the window controls, and so on.

He steps on the starter, the engine springs into life, and the car is driven away to the near-by delivery garage where some dealer is waiting to drive it home.

Thus far as we have followed the motor we have touched merely one side of the business of manufacturing an automobile. We have been dealing chiefly with cast iron. Much of the modern car, of course, is made of steel, and the transformation of ingots of steel into automobile parts is in itself a most interesting process.

Near the west side of the River Rouge plant is one of the largest steel mills in the world, half

a mile long, where this is accomplished. At one end are the open-hearth furnaces, where the molten iron is made into liquid steel at terrific heat, and the glowing stream is poured into tall molds which stand on specially designed railroad cars ready to be hauled away. As the metal cools in these molds, it takes the form of ingots.

The long trains of cars are drawn into an adjoining building known as the blooming mill, where the ingots are lifted out of the molds by cranes and dropped into "soaking pits." Space forbids the detailed explanation of all the different steps through which the ingots must pass. Ultimately they reach the rolling mill, where, after heating, they are carried along on conveyors backward and forward, and as they go they pass between the jaws of rollers which reduce their waist measure and lengthen them out into handy forms and sizes. There are ovals, flats, rounds, and so on.

Each long bar has its own destination. Take, for example, the one that is made into ring gears. A bar is cut into short lengths. Each is heated, then placed in a machine that brings the two ends around in a circle until they touch. At the point of union the ends are welded and we have

a completed ring. Another example is the windshield frame. The steel enters one end of a long machine. It has the form of a wide ribbon. Within the machine this ribbon is rolled, rounded, and grooved until it emerges at the other end in the form of long tubing that can be readily cut up into the required sizes, the corners welded together, and the oblong frame completed.

Across the way from the rolling mill is another long building where parts are stamped out of sheet steel. A sheet of flat steel is placed in the jaws of a formidable-looking press, and out of it a fender is stamped. Other presses shape the side or back panels of the bodies. Alongside this building is another, equally long, where springs are formed and where upsetting machines seem to perform miracles. The spring-forming machines used by Ford were the first to produce automatically spring leaves which are exactly alike in dimensions, temper, and caliber.

Although we have now covered quite a lot of ground, we have not yet visited some of the most fascinating parts of the plant. We must not overlook a development in manufacturing which is going on at the present time. It is the use of electric welding in the manufacture of parts. Ford

is pioneering the way in this. More than thirteen hundred welded parts are being used in the present car as compared with less than three hundred just a few years ago.

His engineers have found that instead of riveting three or four parts together into one, those same parts can be electrically fused into a single piece much stronger than under the old method. That is one of the most recent advances in manufacturing. It is being studied everywhere with keen interest.

We have just a few moments left for the glass furnaces and the power plant. We will have to pass by such things as the radiator shop (Ford makes more radiators than anyone else in the world), the making of lacquer, in which he is second largest in the country, the construction of one-piece wheels, in which both the spokes and the rim, as well as the hub, are all welded together; and many other similar operations.

Ford uses about one fourth of all the plate glass made in the country. As in so many other departments he makes this, too, by a revolutionary method. At one end of a melting furnace, sand, soda ash, and other chemicals are inserted.

At the other end molten glass flows out in a continuous stream, having the required thickness.

One of the most difficult problems to solve in perfecting the process was the "lehr," wherein a moving sheet of molten glass 442 feet long had to be supported evenly while it cooled from a temperature of 1,400 degrees to a point where it was cool enough to handle. The rollers on which the sheet now moves are so perfectly lined up and adjusted that at no point is the glass distorted. The diminishing temperature problem is solved by the use of thermostatically controlled gas flames at varying intervals.

Next, the rough glass must be ground and polished, and here, also, it moves along continuous conveyors on machinery developed by Ford men. When the glass emerges finally it is a quarter of an inch thinner and is ready for use. There are four of these furnaces in the River Rouge plant.

The power house really deserves more time than we can spare for it. It is one of the most intriguing as well as intricate buildings in the entire plant. It supplies power to move the machinery in all this vast enterprise. Its eight smokestacks, two thirds as high as the Washington

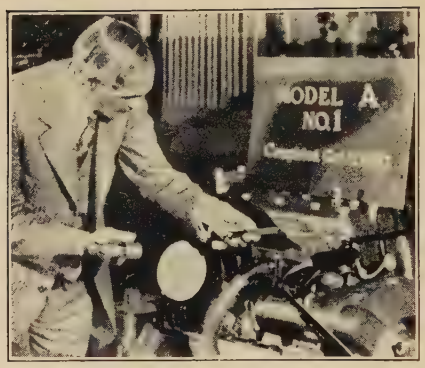
Monument, are comparatively smokeless. Each stack represents a boiler that is eighty-four feet high.

When finished this power house will probably be the largest steam turbo-generator house in America. The power is developed in eight turbo-generators, some of which are Ford-designed and-built. We can reach them by taking an elevator to the third floor of the power house and stepping out on a floor that hums with the march of a hundred thousand horses. The steel castings for these Ford-designed generators were made here in the plant. One of them, twenty-eight feet high and fourteen in diameter, is said to be the bulkiest single casting ever made in this country.

Present plans call for the production of half a million horse power in this building. It now uses more than half a billion gallons of water each day for cooling. This will be increased to a billion a day, more than twice as much as the entire city of Detroit uses, as soon as a tunnel is completed between the Detroit River and the plant.

As we leave the power house and drive down one of the streets leading out of the plant, you will be impressed by the immensity of everything.

An early Ford advertisement and one of the nation-wide announcements of the newest Ford model.



HENRY FORD

numbering the first motor of the new Model A Ford car.

Part of the line of visitors awaiting entrance to Convention Hall in Detroit where forty new cars were on exhibition.

Figures mean little and are hard to grasp, but you have seen thousands of men at work and have noticed how orderly everything is and how systematically everything is done. There seems to be no lost motion. And everything is spotless. Even the Ford locomotives that move back and forth along the countless railroad tracks are spick and span.

It is hard, perhaps, for you to realize that in a single one of these buildings (that given over to pressed-steel parts) more than eighty box cars are loaded with parts every day and sent out to different corners of the world. It is almost equally difficult for you to comprehend the statement that Ford uses half a million freight cars a year to move his products. Yet this problem of moving traffic is just one of the many created by manufacturing on such a large scale.

There is not enough leather in the whole country to take care of his requirements each year, so he must find something else that will take its place. Each day the number of tools and machines which are broken during production mounts into thousands, and all these must be repaired constantly. In fact, two men spend most of their entire time doing nothing but repair mop

pails for the clean-up squad. Other men do nothing but cleanse drinking fountains twice a day. All drinking water used by the men in the plants is sterilized. And so it goes.

These few random items serve to show the complexity of Ford's job—a glimpse behind the scenes, as it were. You may marvel at the system whereby the thousands of men are paid weekly —every day is pay day; you may wonder at the speed with which crates and boxes are made up for shipping parts (as well as at the staggering quantities of lumber used for this purpose) ; you may admire the salvage of such things as lunch boxes and their transformation into cardboard; you will probably exclaim at the savings he has effected merely by extracting nails out of boxes which have come into the plant and are opened.

Most of all, you cannot help recalling, as you look back at the busy plant spread over its thousand acres, that only a few years ago it was mostly swamp land. You feel a thrill of admiration for the genius which first visualized it, then designed and built it, and is now operating it.

CHAPTER XXII

THE AUTOMOBILE OF TO-DAY

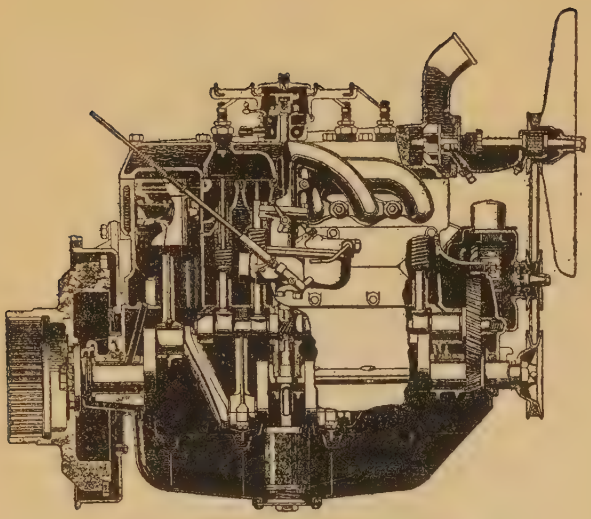
WHEN Henry Ford was a boy he liked to take watches apart to see what made them tick. After he became a man, whenever he found something moving, whether it happened to be an ocean liner or steam locomotive, he quietly sauntered into the engine room and learned for himself how the power was created. His curiosity is not an uncommon trait; all of us are fascinated by things that move. Where Ford differed was in going behind the scenes and finding out how the movement was obtained. Did you ever lift the hood of your dad's motor car and wish you could take off the top of the engine so that you could look down into it and see what made it "tick"?

Basically, most automobiles are alike. Of course, each has its separate points, and the number of cylinders in the motor may differ; but gasoline makes them all go. Lubricating oil must be

used in all of them to keep the metal parts from melting down into a solid mass. Nearly all use storage batteries; and the principle of shifting gears is the same in nearly all. For that reason, when you study the general aspects of one gasoline motor, you will find many things of an interesting and informative nature that apply equally to all.

A motor vehicle may be said to be made up of a power unit; a means of transmitting power to the rear wheels; and the body, chassis, and steering-gear parts which make possible the use of the vehicle as desired. The power plant in turn can be divided into the motor itself with its systems of ignition, fueling, cooling, and lubrication. The transmitting apparatus includes such items as the clutch, the transmission assembly, and the drive shaft.

When we say that a car has four, six, or eight cylinders, we mean that in its engine are four, six, or eight pistons which travel up and down within separate cylinders. Gasoline vapor gathers in the chamber above the piston head and is crowded (or compressed), then ignited by an electric spark. It explodes with considerable force. The explosion drives the piston downward. As it



FORD MODEL A ENGINE IN DETAIL

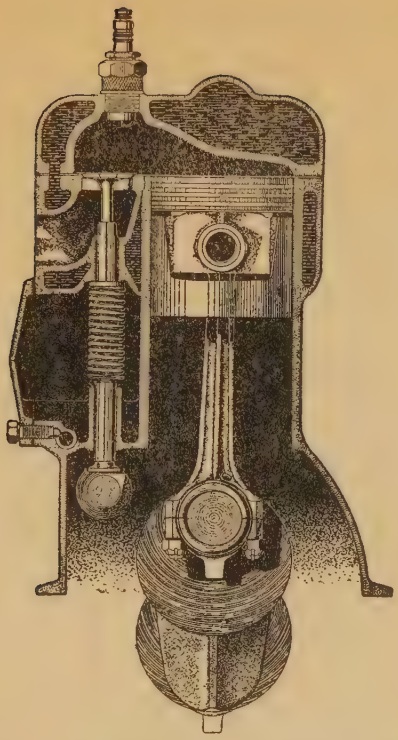
The Ford Model A Engine is an interesting study from a mechanical point of view. At the right top is the fan, and just to the left is the pipe admitting water into the cooling system. Along the top are the four spark plugs. On the extreme left a piston is shown, as well as the rod connecting it with the crank shaft. On the extreme left end of the crank shaft is the flywheel. Below is shown the reservoir of oil.

goes down, it pushes ahead of it a rod which is connected with a shaft below. The shaft is shaped like an eccentric and is made up of a large number of small cranks joined together. It obeys the push of the piston and rod and in turn goes down for a short distance. But it is so constructed that after it passes the bottom point of a circle, it keeps on going around the circle back to where it started from originally.

As it returns, it pushes upward on the *connecting rod,* and the rod in turn pushes upward on the piston. The piston is forced up to the top of the cylinder, ready for the next explosion. This, briefly, is one revolution of the *crank shaft.*

The firing of the gasoline vapor is so timed that each piston is pushed down at just the proper moment to turn the crank shaft. When you have four, six, or eight pistons all bobbing up and down in rotation you can make the crank shaft revolve steadily.

The next problem is to convey this revolving movement to the rear wheels so that the vehicle may go. That would be simple enough if the only thing we had to do was to connect the crank shaft to the rear axle and let the former turn the latter by interlocking gears. But that would not permit



CROSS SECTION OF CYLINDER BLOCK AND HEAD SHOWING WATER JACKETS AROUND CYLINDERS AND VALVES

Here we have a cross section of a motor or cylinder block. On the top sits the spark plug, with its lower end projecting into the combustion chamber (shaded black). The chamber is surrounded by a water jacket (broken lines). On the right is the piston ready to descend, pushing ahead of it the connecting rod, which is fastened at its lower end to the revolving crank shaft. On the left is the valve, opening at the top into the combustion chamber; and being operated at the lower end by the cam shaft.

us to control the power. We might want to change the speed from slow to fast, or vice versa. We might wish the car to stand still while the engine was still running. These and other needs compel us to interrupt the transmission of power by inserting a "damper." In other words, a *clutch*.

The clutch enables us to disengage or reconnect the power at will. We alter the power and speed by means of a set of gears of varying size, "shifting" from one to another by using a lever beside the driver's seat. If the car were powered by steam or electricity, neither clutch nor gears would be needed, since the flow of power could be increased or diminished directly at the source. But the gasoline (or internal combustion) motor is not so flexible.

It would damage both motor and axle to bring the car suddenly from a standing position to a speed, say, of fifteen to twenty miles an hour. In climbing hills, in heavy sand, mud, or snow, and in reversing the car, a change of speed (gears) is not only helpful to the driver but a necessity. When the car is going at high speed strength of pull is not so important, and hence a direct drive from the motor to the rear wheels is used when the car is in "high gear."

To enable the driver to change speeds most cars use counter-shaft gears, a parallel set of gears underneath the shift gears. Each of the counter-shaft gears has a different number of teeth, and thus produces a different speed, when the shifting gears are meshed with it.

When changing speeds there must be a complete severance of motor power from the drive shaft and rear wheels. For that reason you "throw out" or disengage the clutch. In other words, you depress the clutch pedal with your foot. The action moves a bracket or arm and pushes the clutch itself away from the *flywheel*. Since the flywheel turns with the crank shaft, this separation deprives the transmission gears of their power connection.

On the other hand, when you release the pedal, the clutch presses back at once against the flywheel and power is transmitted through the *drive* shaft. As the drive shaft turns, at its far end it moves a gear which passes the power to the rear axle. In other words, its gear fits into gears which are attached to the rear axle shafts at right angles to the driving *pinion gear,* and hence change the direction of revolution from sideward to forward.

Discussion of the various ways of connecting up this driving power can only lead us into technical bypaths, whereas there are one or two important points about rear-end construction that every boy should understand. For example, there is the *differential*. This humble part of the motor vehicle is so seldom seen and performs so satisfactorily that few realize how important it is.

The differential makes it possible to control a motor vehicle when going around corners. At that time, of course, the outer wheels travel faster than those on the inside. The sharper the curve, the greater the difference in speed. To allow for this the rear axle is split in the middle; one shaft extends to the wheel on the right gear, entirely independent of the one which extends to the wheel on the left rear. Both shafts, however, are united by the differential gears which are connected with each other and compensate whenever necessary for the difference in speed of the two rear wheels.

The differential is really a balancing gear between the two halves of the split axe. It would not be needed on a motorcycle because that vehicle has only one rear wheel. In the old days some of the early cars drove through only one of

the rear wheels, the other rolling along as a sort of trailer. The differential has certain drawbacks; for one thing, fewer cars would get stuck in the mud if we could get along without it.

In such manner the power flows from its creation in the motor to its service in the rear wheels. If there were nothing more to the motor vehicle the story would be a fairly simple one. But we have only just begun to examine it. Did you ever think of the family car as a sort of miniature city, with its own water system, its own power and lighting system, and in many cases its own heating system?

The many functions which it is called upon to perform are surprising. Take, for example, the power plant. In addition to the creation of power it must keep that power going. The gasoline must be mixed constantly with air, then the vapor must be regularly exploded. The burned gases must be removed from the cylinder head (combustion chamber) so that they will not interfere with the mixture. The motor and its parts must be kept cool and must be constantly lubricated. A flywheel must be provided to store up energy and momentum and thus aid the crank shaft. Many other things must be considered, so many that in

our limited space we can touch on them but briefly.

One technical authority has compared the action of the gasoline engine to the firing of a muzzle-loading gun. There are four distinct operations: the loading of the powder (intake of the gasoline); the ramming home of the charge (compression of the vapor); firing of the gun (explosion of the vapor); and clearing out the smoke (or exhaust of burned gases). There is but one power stroke—when the charge is fired. To help keep the momentum going during the period intervening before the next power stroke, a fly-wheel is used. It is attached, as has been already stated, to the end of the crank shaft nearest the body of the car, and turns whenever the shaft does. It is so large and heavy that once it is started in motion, it gathers momentum and helps the crank shaft to take up the slack between the power strokes.

At the far end of the crank shaft is a gear which fits into another, and thus turns another shaft. This shaft controls the movement of the *valves*. They open to let the burned gases escape; and close when the vapor flows in prior to firing. The valves are timed so that they open when the

piston has reached the bottom of its descent; and they remain open letting out the burned gases, while it pushes upward. Then they close. This timing is effected by projections which extend out from the sides of the shaft and which turn at just the right time to make the valves open or close. These projections are called *cams* and the shaft itself is the *cam shaft*.

In the four-cycle motor, which as you know means simply that four operations have been performed every time there is an explosion, the operations are: Intake, Compression, Explosion, and Exhaust. These four things involve two up strokes of the piston and two down strokes, in other words, two complete revolutions of the crank shaft. Since it is necessary to clear away the burned gases after only one of the down strokes, the exhaust valve needs to open but once for every two revolutions. In other words, the cam shaft turns only half as fast as the crank shaft. It revolves once while the crank shaft revolves twice.

There are many different types of valve construction, all of which have their proponents. The location of the valves influences the shape of the cylinder head where the explosion takes place, hence it is important. The most important thing

to remember about valves is that the burned gases should be discharged rapidly and the clean gasoline vapor admitted readily. If that is done the flow of power will not be obstructed.

The ignition system of your car is another interesting auxiliary of the motor. It introduces the *storage battery* and the *spark plug,* as well as several other devices that were developed for the automobile. During the early days the problem of making the gasoline explode was a hard one. A burning flame was kept alongside the head of the cylinder, separated from the chamber by a slide. This was opened at the right moment, and the flame ignited the gasoline. Then it was closed until the flame was needed again.

Such an arrangement, of course, was awkward, and could not be used when engineers began to compress gasoline vapor in order to get more force in the explosion. Every time the slide was opened some vapor would escape. To-day most automobiles use an electric spark from a spark plug. It is necessary to create electric current; to time the "spark" so that it will explode the vapor in each cylinder at the right moment; and we must also provide connections or wires to conduct the current to the spark plugs.

The storage battery stores up electricity, but as this electricity is drawn from it continually when the car is in use, it must be again charged—that is, a current of electricity must be sent through it—if it is to continue to render service. The more you use a battery, the less strength it has. On the modern motor car we require the battery not only for ignition of the vapor but also to turn over the *starting motor* and to provide electric lights in front and rear and on the dash for night driving.

To furnish a supply of current for the battery it has been found desirable to attach to the motor a *generator,* which generates electric current when the motor is running. On the Ford car this is located at the front end of the motor, where it can be driven by the fan belt running off the crank shaft. In other words, as the crank shaft revolves, it sets in motion a miniature power plant which provides current.

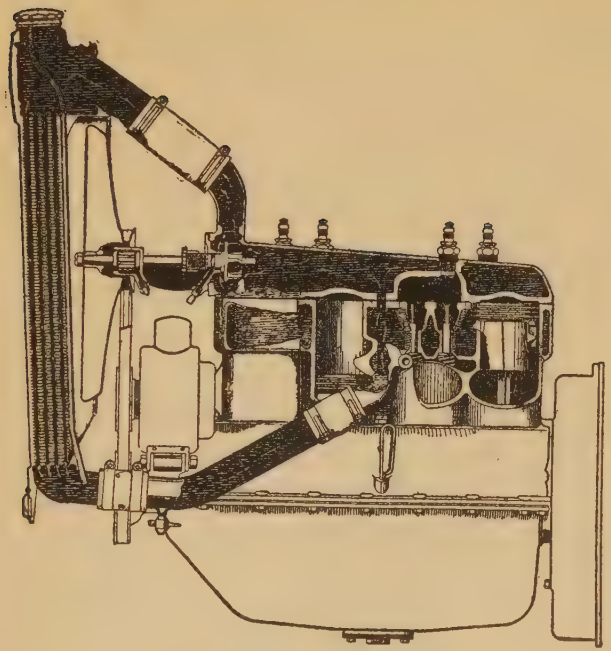
There is a certain definite time which has been determined as the right moment for the electric spark to leap across the gap between the two electrodes of the spark plug. That is at the end of the up stroke of the piston which compresses the gasoline vapor. At that instant the vapor, by

reason of the compression, will exert much greater force than at any other time. The devices used to accomplish this timing differ among different makes of cars.

One of the most noticeable "knocks" to develop in the gasoline motor is caused by "early" timing. The explosion takes place while the piston is on the upward move, instead of at the top of its stroke.

The spark plug is really what its name implies, a plug made out of some sort of insulating material, porcelain or mica. It carries two terminal electrodes, which are separated by the insulating material. Between the two terminals is a gap across which the electric current jumps. This end of the plug extends, of course, into the cylinder head, so the spark will instantly ignite the gas at the moment it makes its leap.

Another important adjunct to the motor is the instrument which mixes the gasoline with air to form the vapor exploded in the combustion chamber. This is the "carburetor." Most modern cars use a "spraying" carburetor in which the gasoline is changed to a fine spray by being drawn or sucked by an air stream through a tiny opening. The proportion of gasoline to air is regu-



COOLING SYSTEM

Diagram showing in detail the cooling system of the Ford car. Here can be seen the radiator and the flow of water. It fills the cavities around the cylinder heads and cylinders and finally returns to the upper end of the radiator on the left. As it descends through the radiator it is cooled again.

lated so that just the right charge can be secured. Modern fuel is not the high-grade gasoline used in the early days, and consequently added devices are needed to secure the best results. One of these is a *hot-spot manifold*.

But we must hurry on. Both the cooling and lubricating systems of an automobile are tremendously interesting and we could linger over them for several enjoyable hours. In most cars as in the Ford car, water is used for cooling, although air is used in the Franklin car and in other motor types. It should be easy for you to understand why it is necessary to cool the engine. The means used is also simple. When the engine block is made, pockets are left so that the water can circulate around the cylinders. Since these surround the cylinders they are called "jackets."

A large surface for cooling is provided in the front end of your car, the *radiator*. Behind it a fan whirls when the car is in operation, increasing the cooling effect. A water pump, which sets at work when the engine is started, sends the water circulating around the motor block and back through the cooling surface of the radiator. On the Ford car both the pump and fan are driven by a belt from the front end of the crank

shaft—the same belt, by the way, that serves the generator as previously described.

The water is forced up from the lower end of the radiator, through the jackets where it becomes heated. It returns to the upper part of the radiator as hot water. It then descends through the radiator in thin streams against comparatively cool metal walls. By the time it has reached the bottom it has lost much of its heat and is sent back through the motor block channels once more.

Lubrication is just as essential as cooling, but it offsets a different sort of heat, that of friction caused by metal parts rubbing against each other. This heat will cause the parts to stick together unless a film of lubricant can be inserted between them. The lubricant must be able to withstand heat and also not separate easily.

Although the methods of causing lubricants to circulate through the motor may vary on different cars there are several points which apply equally to all. Most cars provide a reservoir for holding the oil and automatically circulate that oil by means of a pump when the engine is operating. To-day's car owner needs to give little attention to the lubricating system except to see that a proper amount of oil is constantly on hand and

that when it is worn, it is drained out and fresh oil put in.

The lubrication of the car is so important that it deserves special thought by every boy who takes any interest in motor cars. For one thing, too much oil is likely to cause trouble. Another thing, oil will wear out just like everything else. Proper lubrication is the most important thing in the operation of any gasoline engine.

The wearing of the side walls of the pistons or cylinders will allow the lubricating oil to get into the combustion chamber and build up a sooty deposit known as "carbon." That is prevented to a large extent by *piston rings*. The function of piston rings is interesting. Pistons cannot be made exactly the same size as the cylinders, because they travel up and down within the walls of the latter. The clearance must be enough to allow for expansion due to heat, and also to permit oil to lubricate the walls.

With such clearance it would be possible for some of the vapor to escape down past the pistons during compression, and some of its force would be lost. By fitting rings around the pistons—able to open or close according to the fit of the piston within the cylinder—the vapor can be held back

in the chamber. The rings must be elastic enough to take the form of the cylinder wall, and not obstruct the travel of the pistons. They must be split so that they can expand or contract as needed.

These things may serve to explain to you a few of the most important mechanical details of the modern motor car. Naturally, whole books would be required to describe everything, and we cannot give you here more than the bare outline. As you have read this chapter you may have become interested enough to make a more detailed study of the vehicle. At any rate, you can realize how tremendous are the developments and improvements that have been made in the automobile since 1892–1893, when Henry Ford made his first "horseless carriage."

CHAPTER XXIII

CONCLUSION

IF YOU chanced to live in Dearborn you would know Henry Ford. Often you would see him driving past in one of his cars. You would see him at affairs at the high school. If you were a girl, you might dance with him at one of the old-fashioned dances in his handsome experimental laboratory.

Henry Ford's home, while a stately mansion of stone overlooking the River Rouge, is by no means a rich man's palace. It is rather the home of a country gentleman presiding over its acres of farm land. In its grounds are to be found beautiful flower gardens which Mrs. Ford tends personally. There are many bird houses where feathered songsters are always welcome. There are herds of deer grazing placidly in the fields. Back in the woods is a log cabin where Henry can retire and cook his own meals, if he desires. At Christmas time the little tots of Dearborn find

Santa Claus's workshop hidden in the woods with reindeer and sleigh near by, and Santa himself making toys for them.

Henry Ford's tastes are just as simple as ever. He does not admit yet that he has achieved success. He says that when he has reached that point he will stop work, and he is not yet ready to quit.

He dresses, eats, and lives simply. His clothes are not flashy; his only jewelry is his watch. His diet is plain and wholesome. Fancy foods and overeating do not appeal to him. He attributes much of his amazing health and energy to his plain diet and to keeping in physical trim. He is a great walker, and enjoys a ramble over his estate or through his factories.

During his absences from home he is never surrounded by a retinue. Indeed, he drives back and forth from his laboratory to his home as modestly and unostentatiously as his humblest employé. With his men he is just as unaffected. He talks with the youngest as well as with the oldest. Few great men are as approachable or as easy of access, when proper occasion warrants.

He has restored his father's and mother's home so that it is, as nearly as possible, like it was when they lived there. The barn door is always kept

open for the swallows to nest there, as they did of yore. And he has reprinted the entire set of McGuffey readers from which he studied as a boy. He has done this so that their influence may not be entirely lost to the world.

Through his efforts there has been a revival of the old-fashioned dances with their stately steps, their merriment, and their lessons of courtesy. The Dearborn school children are invited often to dance these steps on his own private floor in the laboratory.

Near the laboratory he is developing a museum that will perpetuate the conditions of life as they were in the old days. Here one will see the shop wherein Edison perfected his early inventions. The old grist mill will be found grinding its grain; the historic tavern will offer its hospitality; the blacksmith, cobbler, tintype artist, printer, grocer, and all the other professions, as in bygone days, will appear in real life.

For much the same purpose he purchased and restored Wayside Inn in Massachusetts and Botsford Tavern in Michigan.

During his lifetime he has met most of the great people of the earth. His friends have been

chosen from among those who contributed to the progress of the world. His first airplane ride was in the *Spirit of St. Louis* with Colonel Lindbergh at the controls. Thomas Edison, John Burroughs, Luther Burbank, and Harvey Firestone have been among those he has known and whose friendship has been dear to him.

His only son, Edsel, has grown to manhood as a thoughtful, capable young man without so many of the traits that characterize many heirs to great wealth. He is democratic and a good listener among his associates. At the same time he is decisive in his actions and has assumed more and more the burden of the great activities created by his father. In his upbringing and training he has been developed into a worthy successor to his father—as great an achievement, almost, as the creation of the business itself.

In governing his organization Henry Ford has attained still another notable success. Despite the army of men serving him he has never had a strike in all his experience. Many of the men who were associated with him in the early days became millionaries. Many more have made themselves financially independent. In his in-

auguration of the five-dollar minimum, in his provision for payment of a bonus, and in his encouragement of thrift he has sought to instil the principles of financial independence throughout the whole organization.

His contact with the world has reflected glory on him. Few men have enjoyed wider fame than does he, although he has never held public office nor marched to war. His great wealth has never been the subject of criticism. He has stated frankly that he regards his holdings only as a means of service. And he has demonstrated his sincerity by investing and reinvesting in his business, providing more and more work for men. Indeed, few organizations in the world employ more men than does he.

It is impossible, of course, in such a work as this to cover in detail all the activities in which he has engaged or even to do more than outline his operations in the manufacturing world itself. The Lincoln car, the Johansson gauge, the trimotored monoplane, the "flivver" plane, the "neighborhood plants" scattered through the Rouge and Huron river valleys, his experiments with visual education, his motion-picture department and library, his mooring mast for dirigibles,

the electrification of the D. T. and I. Railroad, and many other developments must be passed over with scanty mention.

Likewise, only the barest reference can be made to countless activities that have all been a part of his life. His summer camping trips; his trips abroad and around the United States; his five-day-week programme; the lawsuits he has battled, winning some, losing others; his School for Nurses, the Clara Ford Nurses' Home; his ideals of work, life, and service—all these and many more details must be omitted from a work such as this.

It is enough to recall that he has accomplished great things without having to go far from home; and that he has remained unaffected and still eager to serve even after a success has come beyond his wildest expectations.

"Work," he has said, "is my first rule of success. What do dreams and ideals amount to if you are not willing to peg away at dry routine labor to make them tangible? Too many men are trying to win success by a short cut. They half learn their lessons at school. They are not thorough when they get into a shop or an office and so they skimp along, depending on good luck or a pull

to land them in a good job where there is little labor and big pay.

"If you are hammering away at something don't give up just because you fail to find the combination the first time. You certainly won't win by quitting.

"One rule I think a great deal of is—*Take time to do things well.* I have always found that it paid to get all the facts I could myself. If you really want to make progress in anything be sure to get first-hand information and don't depend too much on what others may tell you.

"Another perfectly good rule is to be optimistic. What I mean is for you to believe that good is stronger than evil and will eventually triumph.

"Last of all, don't be too proud to do anything within your power to push the business in which you are engaged. Fool pride gets in the way of a man's advancement. So don't be afraid of overalls or a little grease or dirt if such things are a part of the job to be done. Foolish pride never gets a man anywhere. It is a great hindrance."

And Mr. Ford added: "These rules will work because I have tried every one of them."

More than everything else, the outstanding

thing in Henry Ford's life has been his faith, his willingness to wait and work to make his dreams come true.

If one were to choose a sentence in which to epitomize his career it could be very well that saying of the Apostle Paul's:

"Now Faith is the substance of things hoped for, the evidence of things not seen."

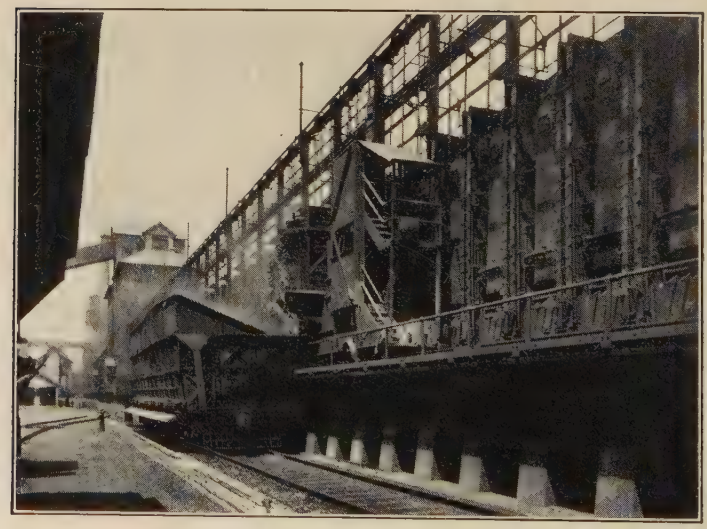
Henry Ford has had faith—and with it he has moved mountains.

THE END

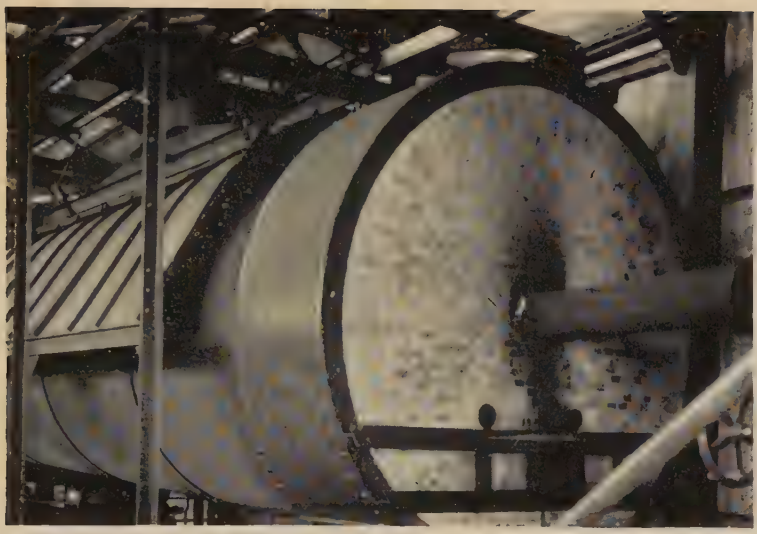
A TRIP THROUGH THE ROUGE PLANT

Airplane view of Ford plant on River Rouge, near Detroit, pronounced one of the greatest industrial enterprises of history. In the background may be seen the city of Detroit. In the right center beyond the turning basin are the coke ovens, and to their left is the power plant with its eight smokestacks. On the left of it is the foundry, the largest in the world, and on this side are the blast furnaces. The storage bins for ore, coal and limestone extend along the River Rouge slip. On this side of the slip extending towards the left edge of the picture is the steel mill. In the river may be seen a few of the 199 salvaged ships purchased from the Government.

Along this waterway in the heart of the Rouge plant are located the immense storage bins for ore, coal and limestone. Ford boats bring the materials from the Ford mines and the unloading takes place at this point. The capacity of the bins is two million tons.



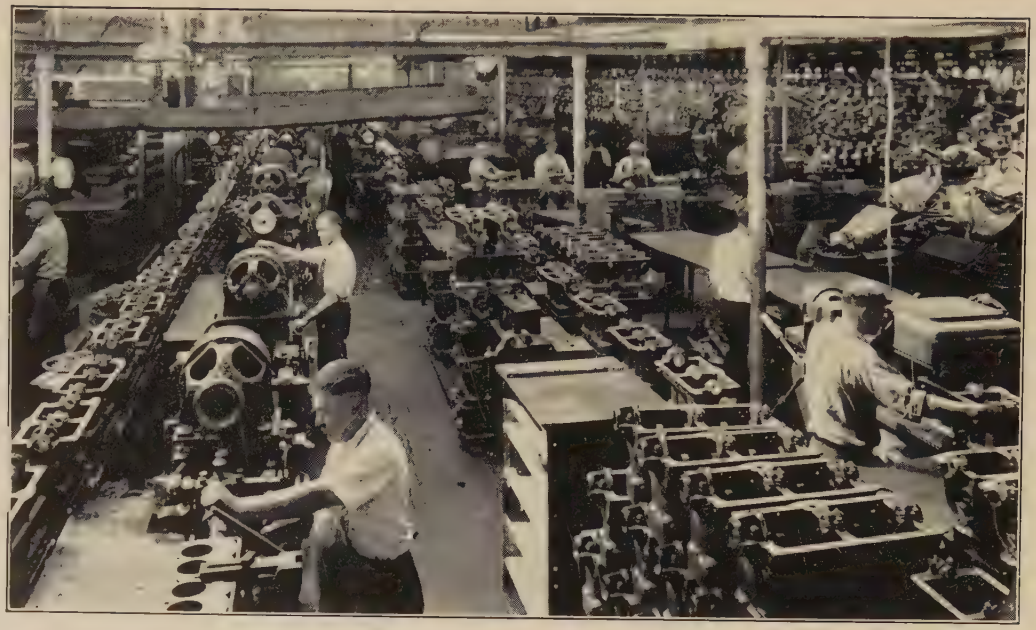
Where Ford makes his own coke and by-products. The car stands on the tracks waiting to receive the coke which is being thrust out of the ovens, red hot, by an electric ram. Each oven, which is a longitudinal section of the battery, holds four tons. As soon as the car is full, it is run under a tower and quenched with cold water.



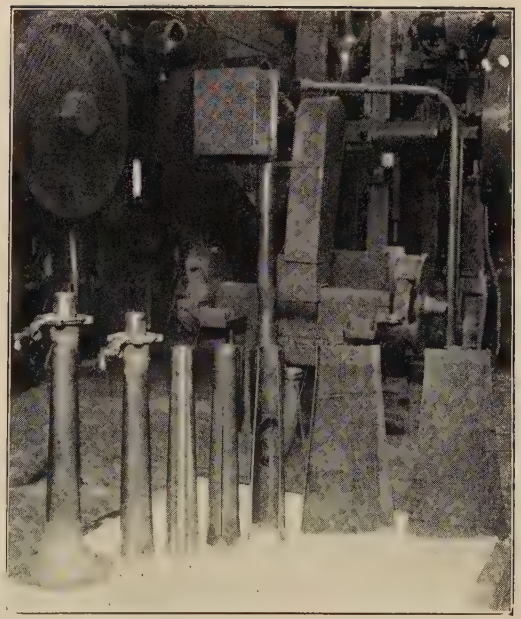
Slag and dross from the Rouge blast furnaces were at one time used for road building; now they are conveyed to a plant near the furnaces and made into cement in the kilns shown in this picture.

Ford makes his own iron in his own blast furnaces. The iron while still hot is taken to the foundry, the largest in the world, and as the conveyor brings the moulds past the pouring station, the hot metal is cast into cylinder blocks.

About three hours are required to machine a motor casting, in the Rouge foundry. The machine in this photograph, one of many designed by Ford men, mills the ends of cylinder blocks.

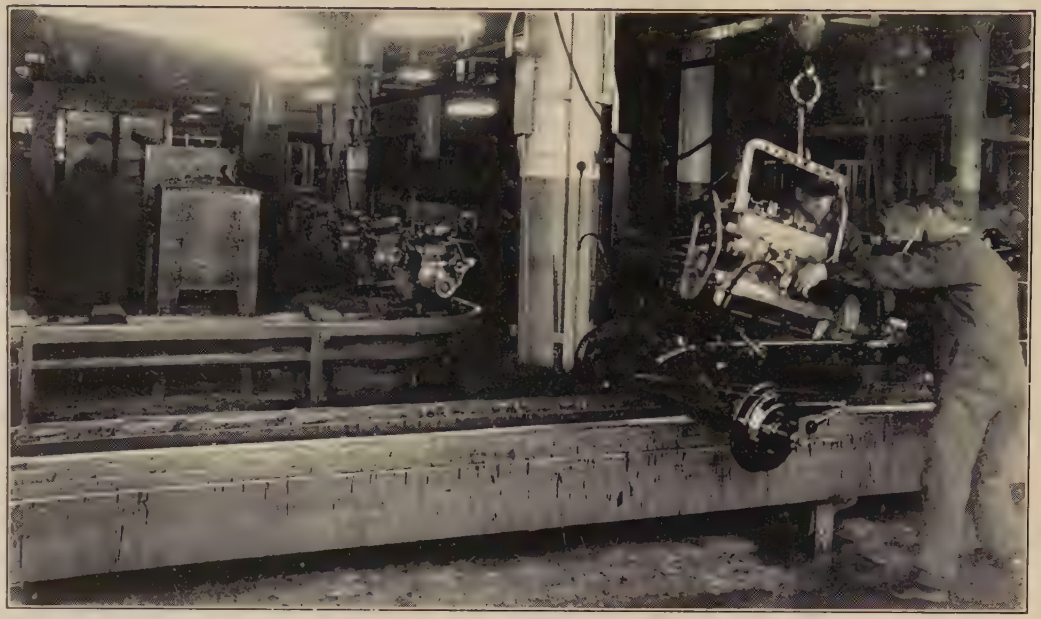


One entire building in the Rouge plant is devoted to motor assembly. Here as many as 9,000 motors have been assembled in a single day.



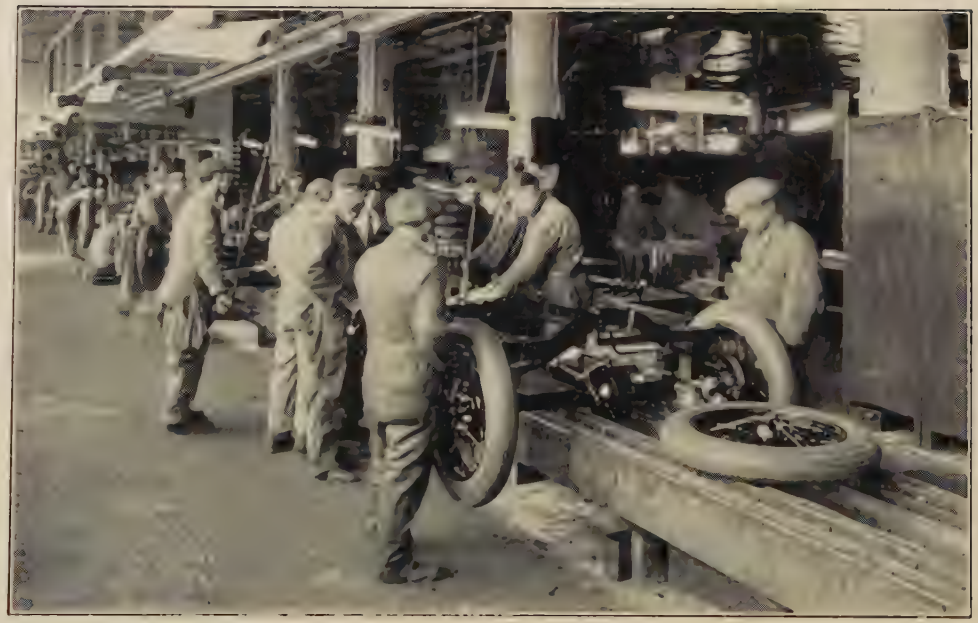
Left: An important part of motor manufacture is the constant testing of each individual part. This picture shows the weighing of the piston and connecting rod assembly.

Right: The evolution of an automobile part. How welding is entering more and more into the joining together of automobile parts is illustrated by this picture. The raw material is represented by the sheet steel on the right of the picture. It is rounded in the form of a tube, and the seam is welded. Then the other parts are joined to it by welding at either end until the finished part is shown on the extreme left.

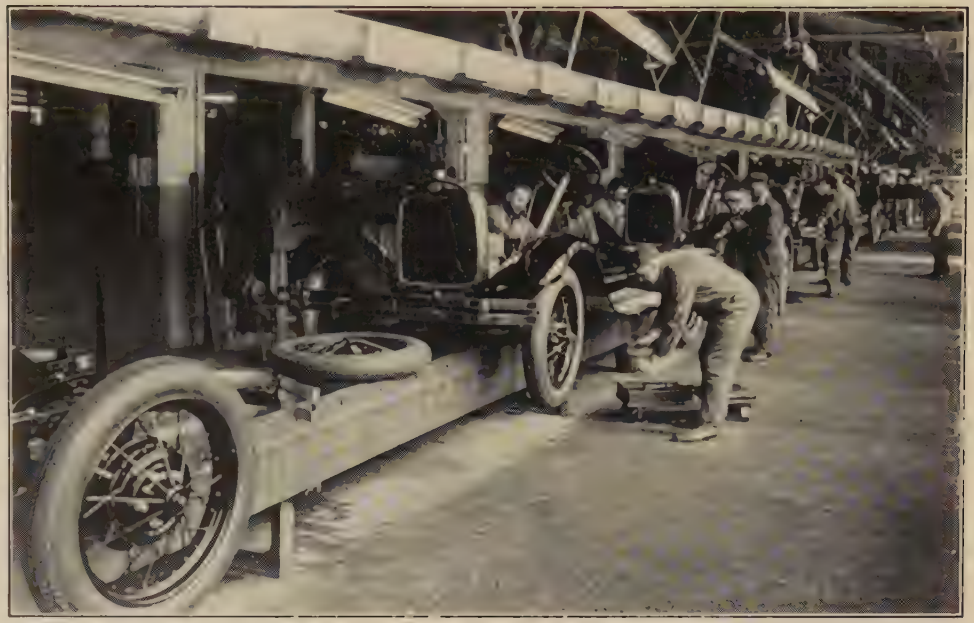


THE MOTOR JOINS THE CHASSIS

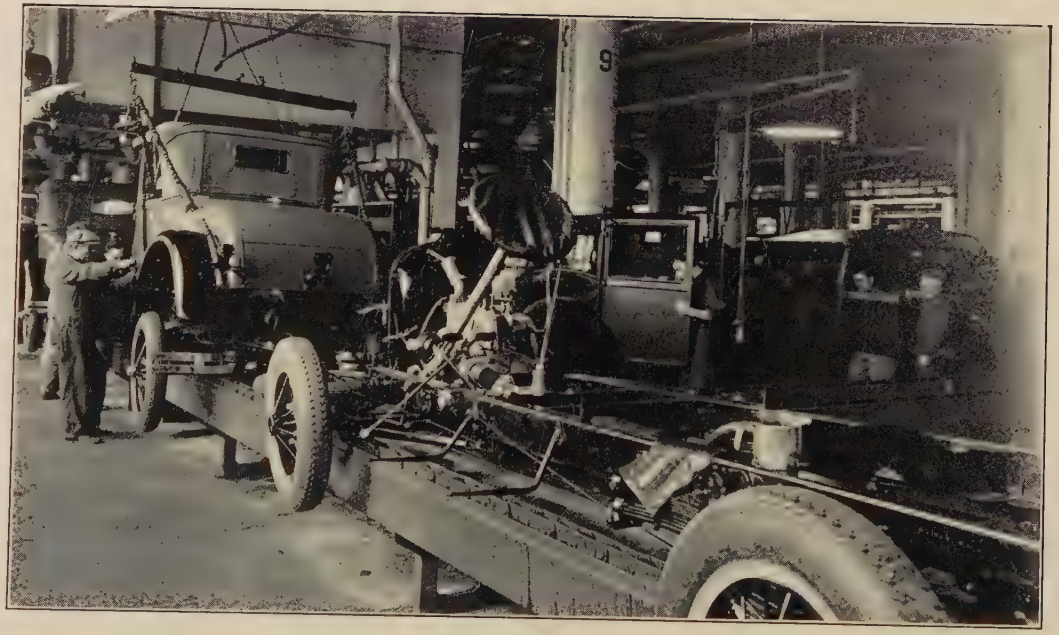
In the general assembly building, the motor approaches the chassis on a side conveyor. At this point, it is swung over and fitted into the skeleton-like chassis that later is to become a completed car.



Tires and wheels are being added to the chassis at this point.



Running boards and fenders being assembled to chassis.



WHERE THE BODY CONVEYOR
JOINS THE GENERAL ASSEMBLY CONVEYOR

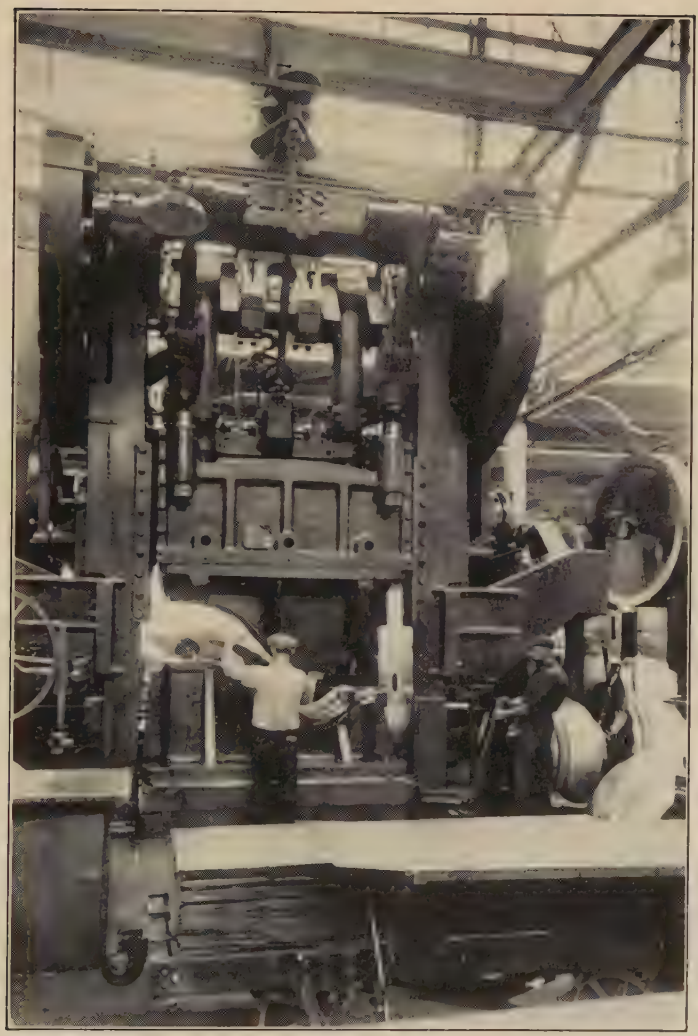
At this point the bodies are swung over and fitted to the chassis. In the picture the body conveyor line is on the right. The workman in the left background is guiding the fitting of a runabout body to the chassis.

THE END OF THE ASSEMBLY LINE

Only a few more finishing touches remain before the car can be driven off the line under its own power.

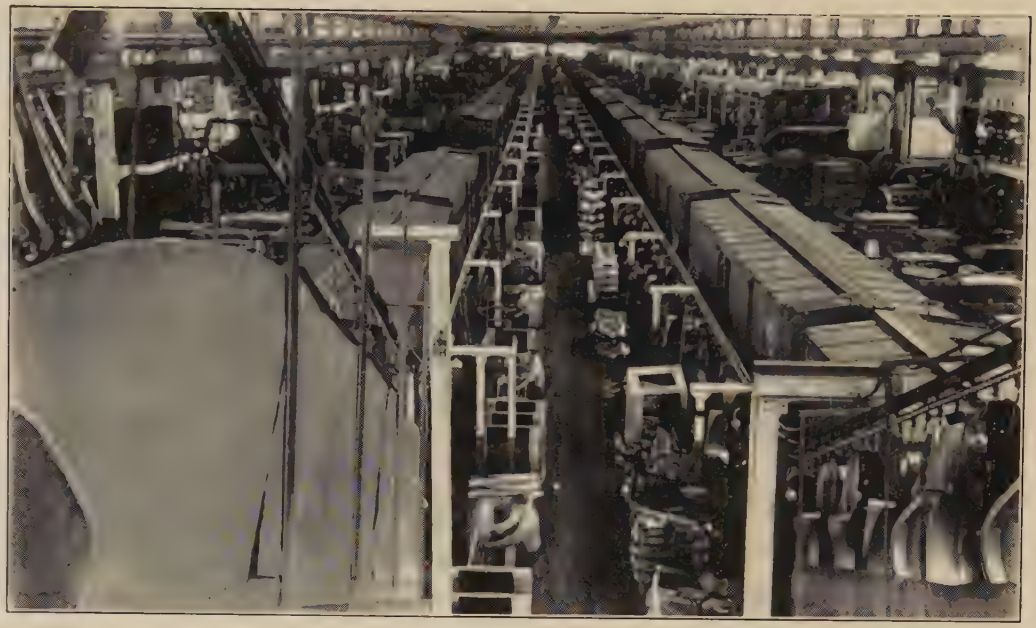
Left: Ford manufactures his own steel. His steel mill, more than one-half mile long, is considered one of the most advanced in the United States. In this picture a corner of the rolling mill is shown, with a red hot ingot being rolled into size.

Right: In a corner of the Open Hearth is a Ford-designed machine known as a hot metal mixing machine. It performs the function of a thermos bottle, keeping molten metal at a high heat until ready to be used. The machine can be tilted for pouring and holds 600 tons.



Automobile parts are manufactured in many different ways. Ford developed the process of welding as one means of joining assemblies. Another process is by stamping out parts from sheet metal. The largest presses in the Ford industries are used to make fenders.

Metal bodies are stamped out. The Tudor sedan, for example, is composed of three main sections, the two sides and the rear. When these are united and the cross sills, cowl, windshield frame and other parts are added, the body is ready to join the chassis.



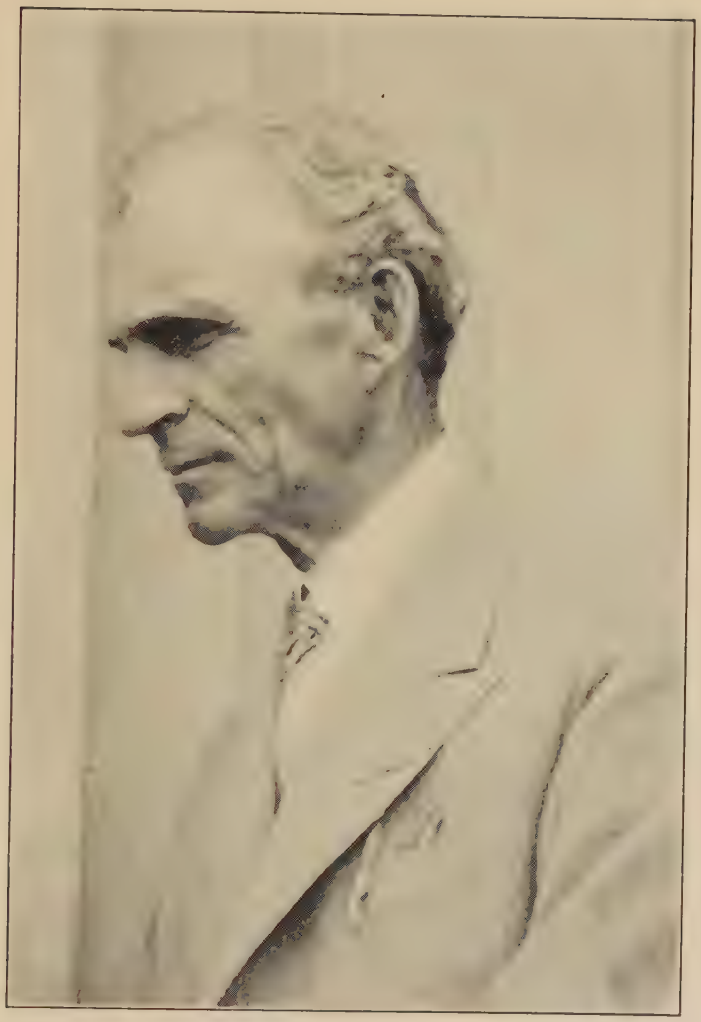
The pressed steel parts are carried by conveyors to shipping platforms where they are loaded on freight cars for shipment to assembly plants. This scene from the Pressed Steel building at the Rouge plant shows where more than eighty freight cars are sent out each day loaded with these pressed steel parts alone.

Making glass by the continuous pouring process was another manufacturing development that "couldn't be done." In this picture the long lines of glass, moving on conveyors, are shown passing under the grinders and polishers.

A TRIP THROUGH THE HENRY FORD TRADE SCHOOL

AT THE PRESENT TIME the Henry Ford Trade School has on hand applications for admission from nearly ten thousand boys more than it can accommodate. The waiting list is never under five thousand.

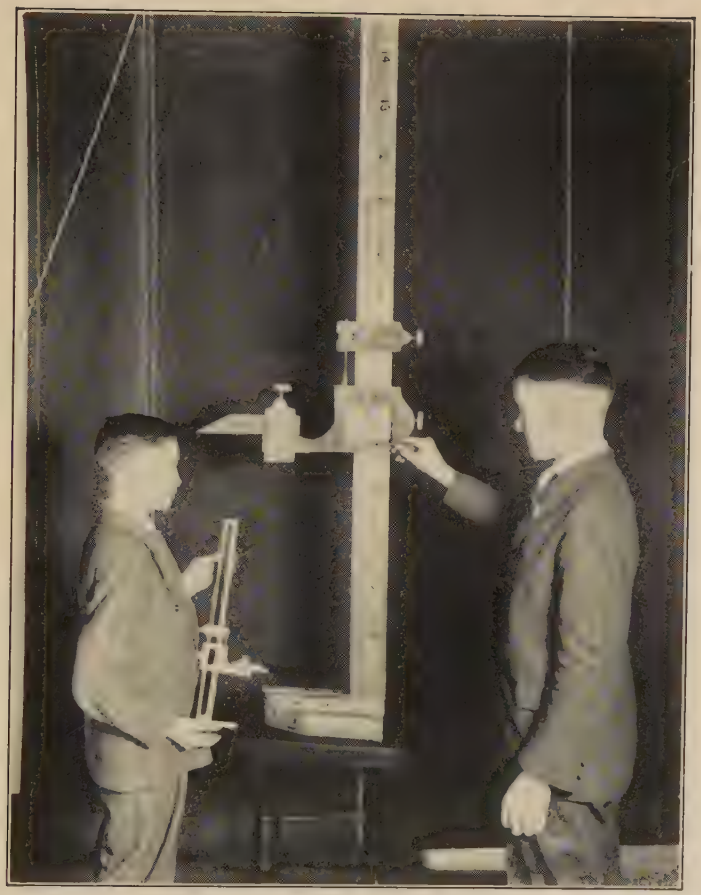
Preference is given to boys who are under-privileged and to sons of Ford workers. These two classifications furnish more than enough boys to fill vacancies that arise.



HENRY FORD

ENTRANCE TO HENRY FORD TRADE SCHOOL

Nearly 3,000 under-privileged boys are enrolled in this school and given an opportunity to fit themselves for life while at the same time earning generous pay, both for the hours spent at class and those in the shop laboratories.



THE VERNIER SCALE

One way of teaching is by using greatly enlarged replicas of the tools and machines and comparing them with the ones actually used by the boys.

SHOP INSTRUCTION IN THE CLASS ROOM

While the boy learns about machinery in this manner, he also learns by actually handling and running the machine.

IN THE PATTERN SHOP

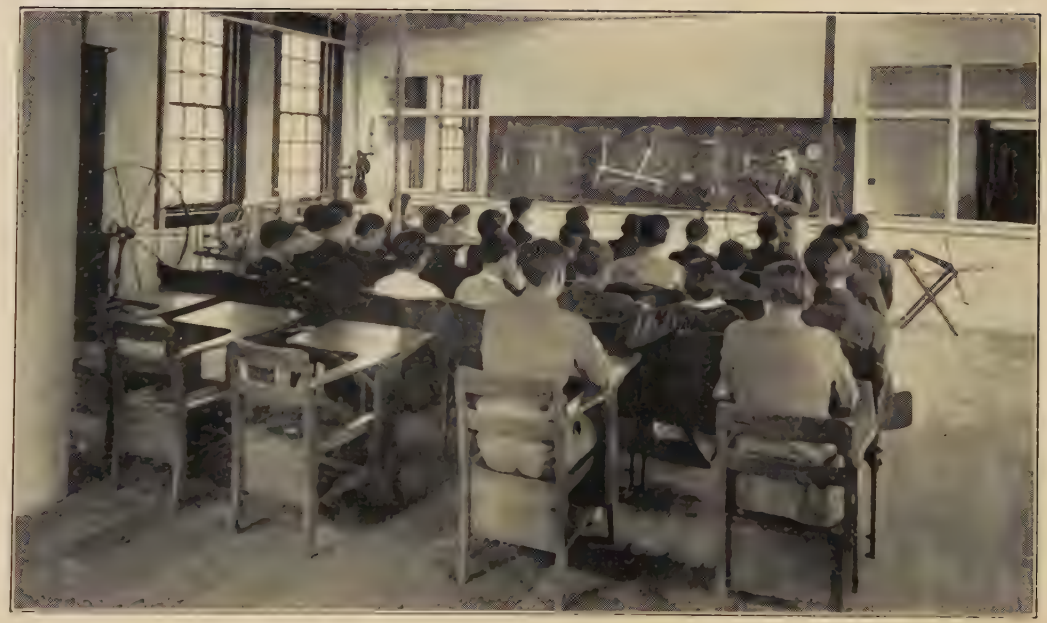
Every boy likes to drive nails, but in the Trade School he is taught to divert this craving to useful ends.

A DAY IN THE FOUNDRY

These boys go through all the foundry operations and make their own castings.

IN THE CHEMICAL LABORATORY

The chemical laboratory is useful in industry if for no other reason than in the testing of materials. These boys learn the practical side of chemistry at the Trade School.



BACK TO FUNDAMENTALS

Another method of study is by going back to the earliest types of tools used and tracing their development. This class is studying textiles and naturally the old spinning wheel is part of the course.